MONTGOMERY WATSON

August 10, 1995

Sheri Bianchin, RPM
Mail Code HSRL-6J
U.S. EPA Region V
77 West Jackson Blvd.
Chicago, Illinois 60604-3590

Re: Revised Dewatering/Barrier Wall Alignment Work Plan
American Chemical Service, Inc. NPL Site
Griffith, Indiana

Dear Ms. Bianchin:

Montgomery Watson Americas, Inc. (Montgomery Watson), on behalf of the ACS RD/RA Executive Committee, has revised this Work Plan to perform borings to confirm the proposed dewatering/barrier wall alignment in response to the comments in your letter dated July 25, 1995, and our meeting held on July 19-20, 1995. As we discussed at our meeting on July 19 and 20, 1995, the ACS plant personnel need to relocate overhead and underground utilities in the area of the proposed barrier wall on-site. Because of the lead time needed to relocate the utilities, the alignment of the barrier wall must be determined in advance of the construction of the barrier walls. This work is a screening level investigation to further estimate the limits of the waste prior to construction of the walls.

Data to be collected and evaluated during the dewatering/barrier wall alignment investigation are:

- Evaluate the lateral extent of waste materials at the locations where dewatering/barrier walls are proposed;
- Collect both field and laboratory geotechnical data (i.e., standard penetration tests and grain size analysis) to aid in the design of the dewatering/barrier walls;
- Better define the depth to the top of clay confining layer along the proposed dewatering/ barrier wall alignment;
- Collect soil samples for slurry wall mix design (for sections of dewatering/barrier wall that will consist of a soil/bentonite or cement/bentonite wall).
- Collect groundwater samples for slurry wall mix compatibility testing (for sections of dewatering/barrier wall that will consist of a soil/bentonite or cement/bentonite wall).

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This Work Plan describes the number and location of borings, drilling procedures, sampling protocols, field testing parameters and procedures, and laboratory parameters and methods to be used to confirm the dewatering/barrier wall location and collect geotechnical data for the dewatering/barrier wall design.

SCOPE OF WORK

Soil borings, test pits and auger probes conducted during the Remedial Investigation (RI) and subsequent phases of investigation (i.e., Supplemental Soil Sampling Program - 1993) have been used to identify the lateral extent of waste materials at the ACS NPL Site. Soils with total VOC concentrations of 1 percent (10,000 parts per million [ppm]) or greater, lead of 500 ppm or greater, and\or total PCB concentrations of 10 ppm or greater are classified as waste in the U.S. EPA Record of Decision (ROD). Previous exploration points in the Still Bottoms/Treatment Lagoon Area are shown on Figure 1 and those in the Off-Site Area are shown on Figure 2. Logs for each exploration point are included as Attachment A. The proposed dewatering/barrier wall alignment, based on these data and aerial photos, for the Still Bottoms\Treatment Lagoon Area is shown on Figure 3, and for the Off-Site Area on Figure 4. The alignment was revised from the May 10, 1995 Work Plan to extend further west in the offsite containment area to encompass the source and mitigate migration of contaminated groundwater.

Field investigations within each area will consist of drilling soil borings along the proposed alignment of the barrier walls, and assessing both visually and through field and laboratory analysis the presence of waste materials. If waste materials are found along the proposed alignment, additional borings will be conducted outward from the waste area using shallow borings to determine the extent of the waste materials. Soil samples will be collected for field analysis of VOCs and PCBs. Lead will not be analyzed for because previous testing has shown lead to be limited to discrete areas away from the barrier wall location. Field analysis will consist of utilizing a field test kit for analysis of PCBs, utilizing a field gas chromatograph (GC) for analysis of total VOCs (defined as the sum total of the concentrations of detected target VOCs), and using a hydrophobic dye to test for the presence of free-phase materials. Duplicate soil samples will be submitted for laboratory analysis when results of field analysis show VOCs close to 10,000 ppm or PCBs close to 10 ppm. Lead will not be analyzed for because previous testing has shown lead to be limited to discrete areas away from barrier wall location, not present here. Based on the previous data, lead contaminated soils will be contained within the walls.

Drilling Procedures

Potential drilling locations will be marked in the field with wooden stakes prior to beginning field activities at locations agreed to with the U.S. EPA and IDEM onsite representatives. A meeting will be held with representatives of ACS to confirm that the drilling locations will not interfere with plant operations and will not impact either overhead or underground utilities. If proposed locations do interfere, they will be relocated to the closest accessible location.

Soil borings will be drilled using an all-terrain vehicle (ATV) mounted drill rig. It is anticipated an ATV drill rig will be required to access many of the proposed soil boring locations in the

Off-Site Containment Area. Soil borings will be drilled with 3.25-inch inside diameter (I.D.) Hollow Stem Augers (HSA) (or equivalent), and soil samples will be collected at 2.5-foot intervals using 2-inch outside diameter split spoons. During collection of split spoon samples, standard penetration data (i.e., blow counts) will be collected for each sampling interval. Samples will be field classified and recorded on field logs. Soil samples will be field screened using a photoionization detector (PID) equipped with an 11.7 eV lamp. Montgomery Watson Standard Operating Procedures (SOPs) for drilling and split spoon sampling of soils are presented as Appendix B. Soil samples will not be composited.

A soil sample will be collected at the interface of the confining clay layer and tested in the field using a hydrophobic dye technique. The hydrophobic dye test consists of placing soil in a 40-ml vial to 1/4 full, adding water to bring the vial to 1/2 full, adding a small amount of dye powder, and then agitating the sample for approximately 30 seconds. The dye, a red color, turns a dark red with the presence of hydrophobic materials (i.e. free phase material). The field screening method will provide an additional indication of the presence of free phase materials. At two locations along each alignment, a 30-inch shelby tube will be pushed into the clay confining layer for the collection of undisturbed soil samples for permeability testing (ASTM D5084).

Soil borings will be advanced to a depth of two feet into the confining clay layer. It is anticipated that the clay will be encountered at depths of between 15 and 35 feet below ground surface (bgs) depending upon the investigation area. Following completion of each borehole, borings will be backfilled to the ground surface using a bentonite-cement grout. To minimize the potential for bridging of annular seal material, grout will be installed from the base of the borehole to the ground surface by pumping via a tremie pipe. In traffic areas within the plant, the top 12 inches of the boring will be backfilled with gravel. Soil boring locations and elevations will be surveyed. Soil cuttings generated during drilling will be contained in Department of Transportation (DOT) approved 55-gallon steel drums, and stored on-site in the designated area for ultimate proper disposal.

Field Analysis Procedures

The soil sample collection procedure is described above. Field analysis for PCBs will be conducted using the EnSys Inc. PCB RIS^c Soil Test Kit. The PCB RIS^c Soil Test conforms to SW-846 Method 4020 for the screening of PCBs using immunoassay methodology. The method has been validated by the U.S. EPA, but is not yet approved. The manufacturer's instructions included with each test kit will be followed (Appendix C). The test kit will be set to detect PCBs greater than 10 ppm. (i.e., the detection limit). Duplicate analyses and blank analyses will be performed for each set of ten samples. The field technician will be trained prior to conducting the procedure in the field.

Field analysis for VOCs will be conducted using a field gas chromatograph (GC) equipped with Hall and PID detectors, and conforms to SW-846 Method 8010/8020. The SOP is attached as Appendix D.

Number of Samples

One to two soil samples will be collected from each boring drilled along the dewatering/barrier wall alignment for field analysis of VOCs and PCBs (Table 1). Soil samples will be chosen for field analysis based on field PID readings, results of the hydrophobic dye testing, and visual

observations. Confirmatory laboratory analyses will be conducted on selected soil samples based on results of field GC analysis for VOCs, and PCB test results.

Laboratory analyses for PCBs and VOCs will be performed on samples from the borings that are located along the "final" alignment, based upon the field testing results (Table 1). Soil samples that exceed 10 ppm PCBs based on field screening will be submitted for laboratory analysis to determine if the PCBs are actually present. If field GC screening shows VOCs are present close to, or above the waste threshold of 10,000 ppm, a sample will be submitted to the laboratory to quantitatively determine the total VOC concentration because the field GC may not detect all VOCs present. Laboratory analyses will be performed in accordance with the Contact Laboratory Program (CLP) Statement of Work by IEA Analytical Laboratory, North Carolina. Laboratory analyses will be performed at Data Quality Objective (DQO) Level 3.

Two soil samples will be collected from borings located at intervals of 200 ft in the Still Bottoms Area and Off-Site Containment Area along the barrier wall alignment for geotechnical analysis. Grain size analysis (ASTM D422) will be conducted on each of the geotechnical samples collected. The number of samples, parameters, and analysis methods are provided in Table 1. Geotechnical analyses will be performed at Montgomery Watson's laboratory in Madison, Wisconsin.

Five soil samples selected from the stratigraphic soil samples (i.e., split spoon soil samples collected for soil classification) will be used to conduct slurry wall clay mix design analysis. The soil samples will be mixed in the laboratory and the resulting slurry will be subjected to permeability testing using flexible-wall permeameters based on ASTM D5084 "Standard Test Method," for measurement of hydraulic conductivity of saturated, porous material (Table 1). The samples will be selected to provide a range of the various soil types that are encountered during the drilling program. Five samples were selected because previous soil borings show that the subsurface sands are relatively uniform across the site, but did vary in grain size at different locations.

A groundwater sample will be collected from well MW-16, representative of impacted groundwater, and will be used as the permeant fluid for conducting compatibility testing on the optimum slurry mix. Samples from MW-16 are expected to be a "worst case" sample of groundwater expected to be in contact with the slurry wall. The test procedure will be based on ASTM D5084 and U.S. EPA SW846 Method 9100, "Saturated Hydraulic Conductivity Saturated Leachate Conductivity, and Intrinsic Permeability" (Table 1).

Boring Locations - Still Bottoms/Treatment Lagoon Area

Twenty-three soil borings at approximately 50-foot intervals will be drilled in the vicinity of the Still Bottoms/Treatment Lagoon Area as shown on Figure 3. The borings will be drilled on 50-foot intervals because the dewatering/barrier wall alignment needs to be well defined in this area because of potential impacts to ACS operations. The depth to clay is estimated to be approximately 21 to 25 feet in the Still Bottoms/Treatment Lagoon Area, and each boring will be drilled two feet into the clay confining layer to confirm the depth to clay. The estimated depth to clay is based on the clay contour map prepared as part of the RI.

The current estimate of waste extent does not indicate that waste extends beneath the railroad

spur located along southwest side of the proposed barrier wall. The borings will be located to confirm that waste does not extend adjacent to and/or beneath the railroad tracks in this area. The information will be used to evaluate whether the presence of the rail spur needs to be incorporated into the dewatering/barrier wall design and construction plans. Total PCB concentrations greater than 10 ppm were noted in soil samples collected from soil borings SB92 and SB93 (Figure 1) at a depth of 3 ft, and therefore, additional PCB testing will be done in this area.

Northwest of the Fire Pond is an area previously determined to contain PCBs at concentrations greater than 10 ppm, and therefore, PCB testing will be done in this area. PCB concentrations above 10 ppm were noted in soil samples collected from boring SB20 at a depth of 7 feet, and in soil samples collected from borings SB90 and SB91 at depths up to 5 feet (total boring depth 5 ft). The borings will be located to confirm that PCBs do not extend to and beneath the railroad tracks in this area.

North of the Fire Pond the borings are located to evaluate the previous results from soil samples collected from boring SB89. Total PCB concentrations above 10 ppm were noted at a depth of up to 5 feet in boring SB89 (total boring depth 5 ft).

East of the Still Bottoms/Treatment Lagoon Area, extent of PCBs was estimated to extend to beneath the container storage area/loading dock. Soil borings will be located to determine if PCB impacted soil does extend to the container storage area/loading dock. Soil borings will also be drilled along the proposed alignment to confirm the delineation of waste noted from borings SB70, SB71 and SB94. Total PCB concentrations above 10 ppm were noted in soils collected from SB70 and SB71 at a depth of 8 ft. The presence of waste was not indicated in samples collected from SB94, located further southeast of SB70 and SB71.

Boring Locations - Off-Site Area

Sixteen soil borings will be drilled in the Off-Site Area at 200 ft intervals along the proposed dewatering/barrier wall alignment as shown on Figure 4. The borings will be drilled on 200-foot intervals because the location of the dewatering/barrier wall in the Off-Site Area is not as sensitive to plant operations as in the On-Site Area. In addition, the proposed alignment is anticipated to be well beyond the limits of waste in this area, so the 200-ft spacing is reasonable. The barrier wall alignment includes the waste areas, as well as the areas with refuse to the east near Colfax Avenue. The proposed alignment extends westward to the site boundary. This was done to prevent the migration of contaminated groundwater in this area. In addition, during rainfall, seeps have been detected in this area, so the wall will prevent migration of this water. The depth to clay is estimated at approximately 28 to 33 ft in borings proposed along the west and south sections of the alignment. The depth to clay is estimated at approximately 15 ft along the north section of the alignment, and at approximately 20 ft in borings proposed along the west portion of the alignment. Each boring will be drilled to verify the depth to the clay. The estimated depth to clay is based on the clay contour map prepared as part of the RI.

Pilot Test Cell Borings

Sheet piles will be used as the barrier wall in Still Bottoms/Treatment Lagoon Area, and the Off-Site Containment Area pilot test cell locations. The information needed to develop the construction specifications for the sheet pile walls include standard penetration testing, field soil

classification, and the depth to clay. Field and laboratory chemical analyses will not be needed and so not be performed on soil samples collected from the Pilot Test Cell borings.

The soil borings will be performed as described aboveunder "Drilling Procedures", including that the soil borings will be advanced two feet into the clay. Up to six borings will be performed in the Off-Site Containment Area and up to four borings will be performed in the Still Bottoms/Treatment Lagoon Area to gather the information needed to locate the Pilot Test Cells. The boring locations will be agreed to in the field with the U.S. EPA and IDEM on-site representatives.

SCHEDULE AND REPORTS

The field team will mobilize to the site within three weeks of approval of this work plan, which will allow time to schedule the drillers and provide the agencies the 14-day notice required by the UAO. The design of the dewatering activities for the pilot testing of ISVE of waste, the materials handling the pilot test, and the LTTT treatability tests are dependent on the results of this investigation. The pilot test cell-related results will be submitted with the Pilot Testing QAPP addendum. The barrier wall-related results will be provided in the Perimeter Groundwater Containment System Final Design report. The work outlined in this Work Plan is shown on the schedule presented with the Pre-Design Work Plan.

CLOSING REMARKS

If you have any questions, please contact us at (708) 691-5000 for assistance.

Sincerely,

Martin J. Hamper
Project Manager

Joseph D. Adams Jr., P.E.
Vice President

Attachments:

Table 1	Sample Number, Parameters, and Methods
Figure 1	Existing Boring Location Map - Still Bottoms/Treatment Lagoon Area
Figure 2	Existing Boring Location Map - Off-Site Containment Area
Figure 3	Proposed Boring Location Map - Still Bottoms/Treatment Lagoon Area
Figure 4	Proposed Boring Location Map - Off-Site Containment Area
Appendix A	Soil Boring, Test Pit and Auger Probe Logs
Appendix B	Drilling and Soil Sampling SOP
Appendix C	EnSys Inc. PCB RIS Soil Test Method
Appendix D	Field Gas Chromatography SOP

PMS/lhd/MJH/JDA
J:\4077\0030\WORK_PL\VER_2\BARRIER\REVPLAN.WPD

T

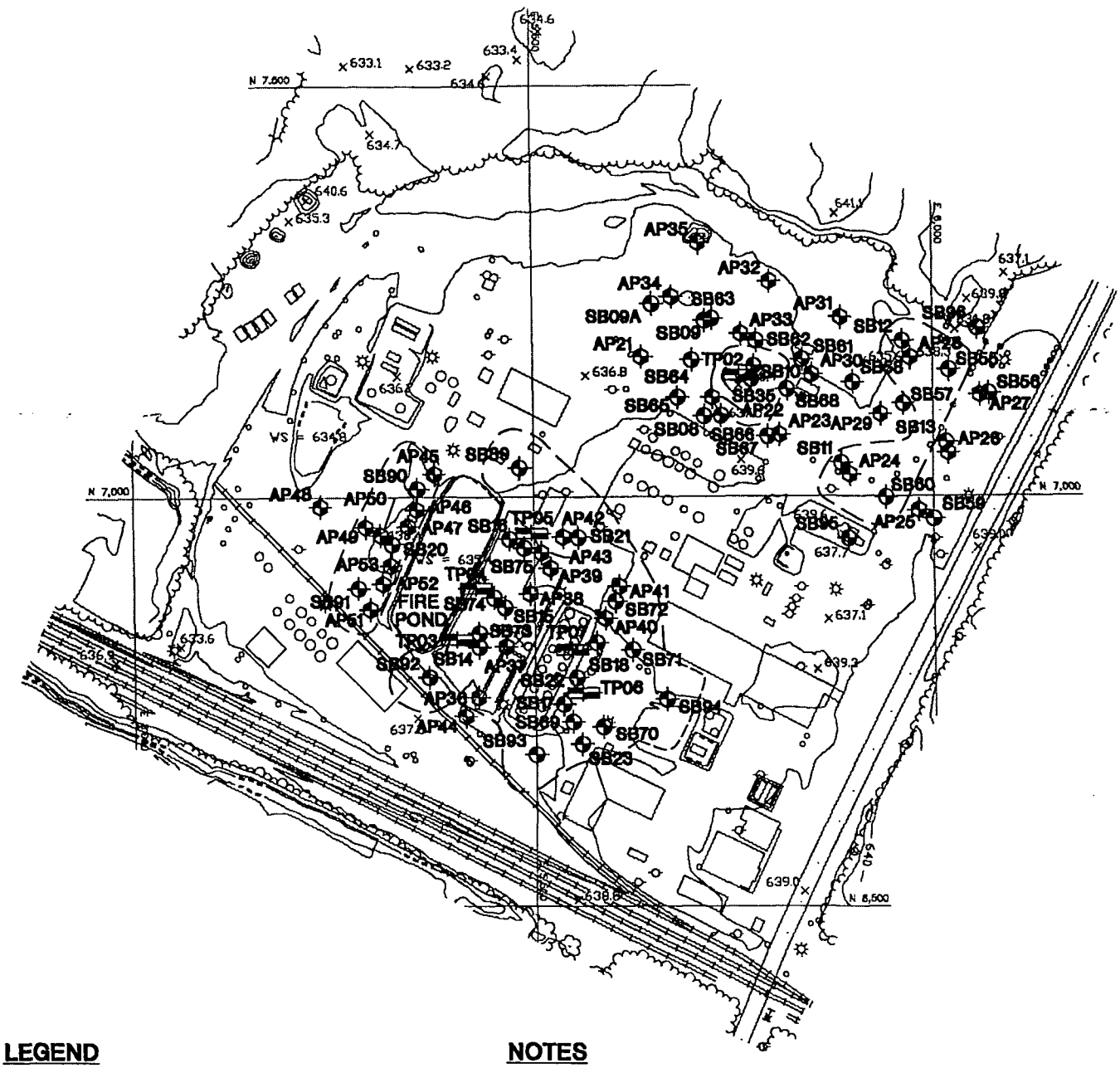
Table 1
Sample Numbers, Parameters, and Methods
Dewatering/Barrier Wall Alignment Work Plan
American Chemical Service, Inc. NPL Site

Investigation Area	Lab	No. of[1] Samples	Field Duplicates	Field Blanks	MS/MSD[2]	Total No. Samples	Parameters[3]	Lab[4] Method
Still Bottoms/Treatment Lagoon Area Investigation	IEA	46	5	5	3	59	Field Analysis - VOCs	SW 846 8010/8020
		46	5	5	--	56	Field Analysis - PCBs	SW 846 4020
		12	1	--	1	14	Laboratory Analysis - VOCs	CLP SOW
		12	1	--	1	14	Laboratory Analysis - PCBs	CLP SOW
		12	--	--	--	12	Grain Size (Sieve and Hydrometer) Analysis	ASTM D422
Off-Site Area Investigation	IEA	32	4	4	2	42	Field Analysis - VOCs	SW 846 8010/8020
		32	4	4	--	40	Field Analysis - PCBs	SW 846 4020
		6	1	--	1	8	Laboratory Analysis - VOCs	CLP SOW
		6	1	--	1	8	Laboratory Analysis - PCBs	CLP SOW
		32	--	--	--	32	Grain Size (Sieve and Hydrometer) Analysis	ASTM D422
Clay Confining Layer	MW	4	--	--	--	4	Hydraulic Conductivity	ASTM D5084
Slurry Wall	MW	5	--	--	--	5	Hydraulic Conductivity	ASTM D5084
Slurry Wall	MW	1	--	--	--	1	Compatibility Testing	ASTM D5084 SW 846 9100

Notes:
1. The actual number of samples will be based upon the field testing results.
2. MS/MSD samples will be collected at a ratio of 1 MS/MSD for each 20 investigative samples.
3. For a complete list of field parameters, see Appendices C and D of the Dewatering/Barrier Wall Alignment Work Plan.
4. SOPs for field methods included in Appendices C and D of the Dewatering/Barrier Wall Alignment Work Plan.

PMS/MJH/JAH/JDA
J:4077\0110\barrier\CONTAIN2.XLS

FIGURES



LEGEND

- SB92 — EXISTING SOIL BORING LOCATION AND NUMBER
- AP36 — EXISTING AUGER PROBE LOCATION AND NUMBER
- TP03 — EXISTING TEST PIT LOCATION AND NUMBER
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- APPROXIMATE EXTENT OF KNOWN SOIL CONTAMINATION

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.

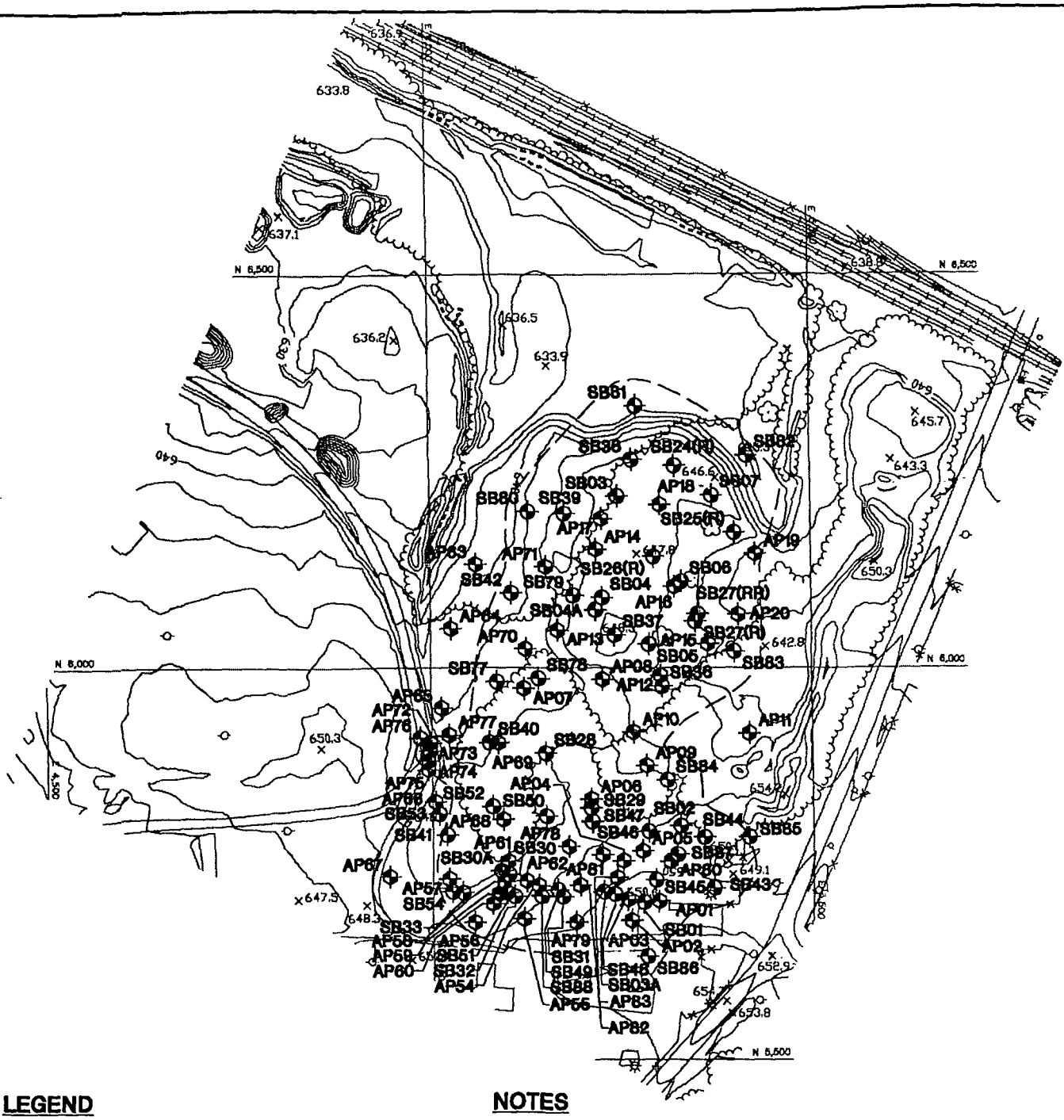
north

0 200 400

SCALE IN FEET

FIGURE 1

Developed By PMS Drawn By TPB Approved By M. Hampa Date 5-10-95 Reference Revisions	**EXISTING SOIL BORING LOCATION MAP- STILL BOTTOMS/TREATMENT LAGOON AREA** BARRIER WALL ALIGNMENT WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	Drawing Number 4077.0110 A1 MONTGOMERY WATSON



LEGEND

- AP67 — EXISTING AUGER PROBE LOCATION AND NUMBER
- SB28 — EXISTING SOIL BORING LOCATION AND NUMBER
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- APPROXIMATE EXTENT OF CONTAMINATED SOIL

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.

north

0 200 400

SCALE IN FEET

FIGURE 2

Developed By PMS Drawn By TPB

Approved By M. HAMPER Date 5-10-95

Reference

Revisions

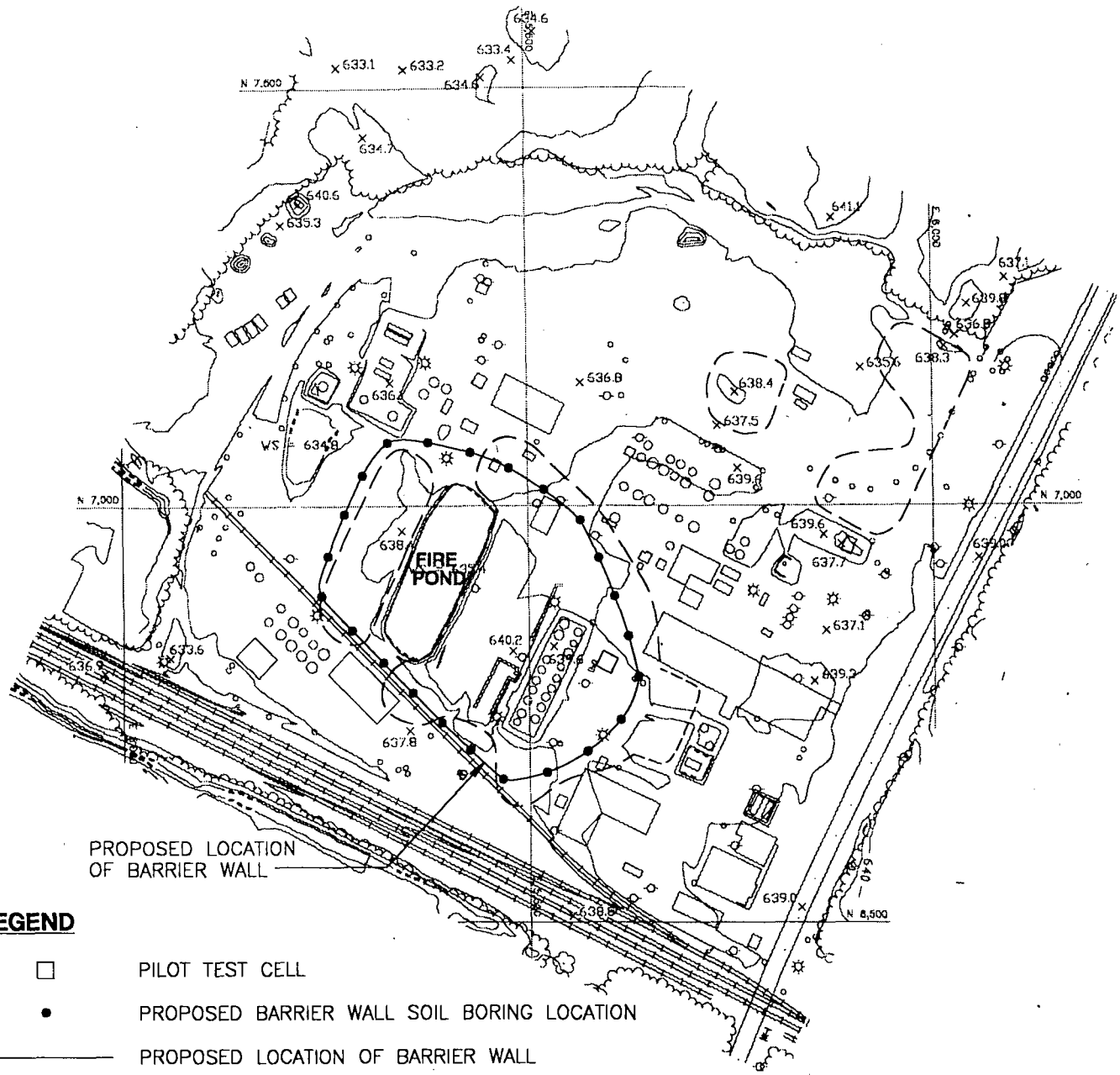
EXISTING SOIL BORING LOCATION MAP-OFF-SITE CONTAINMENT AREA

BARRIER WALL ALIGNMENT WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0110 A2

MONTGOMERY WATSON

QUALITY CONTROL | Graphic Standards | Lead Professional | Technical Review | Project Manager | Management Review | Other



LEGEND

- PILOT TEST CELL
- PROPOSED BARRIER WALL SOIL BORING LOCATION
- PROPOSED LOCATION OF BARRIER WALL
- PROPOSED PILOT TEST CELL LOCATION
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- APPROXIMATE EXTENT OF KNOWN SOIL CONTAMINATION

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.
3. FINAL BARRIER WALL LOCATION IS DEPENDENT ON RESULTS OF SOIL BORING PROGRAM.

north

0 200 400

SCALE IN FEET

FIGURE 3

Developed By	PMS/DAP	Drawn By	TPB
Approved By	M. HAMPER	Date	5-10-95
Reference			
Revisions	REVISIONS PER USEPA COMMENTS DAP 7-31-95 TPB 7-31-95 LCL 8-8-95 & 8-10-95		

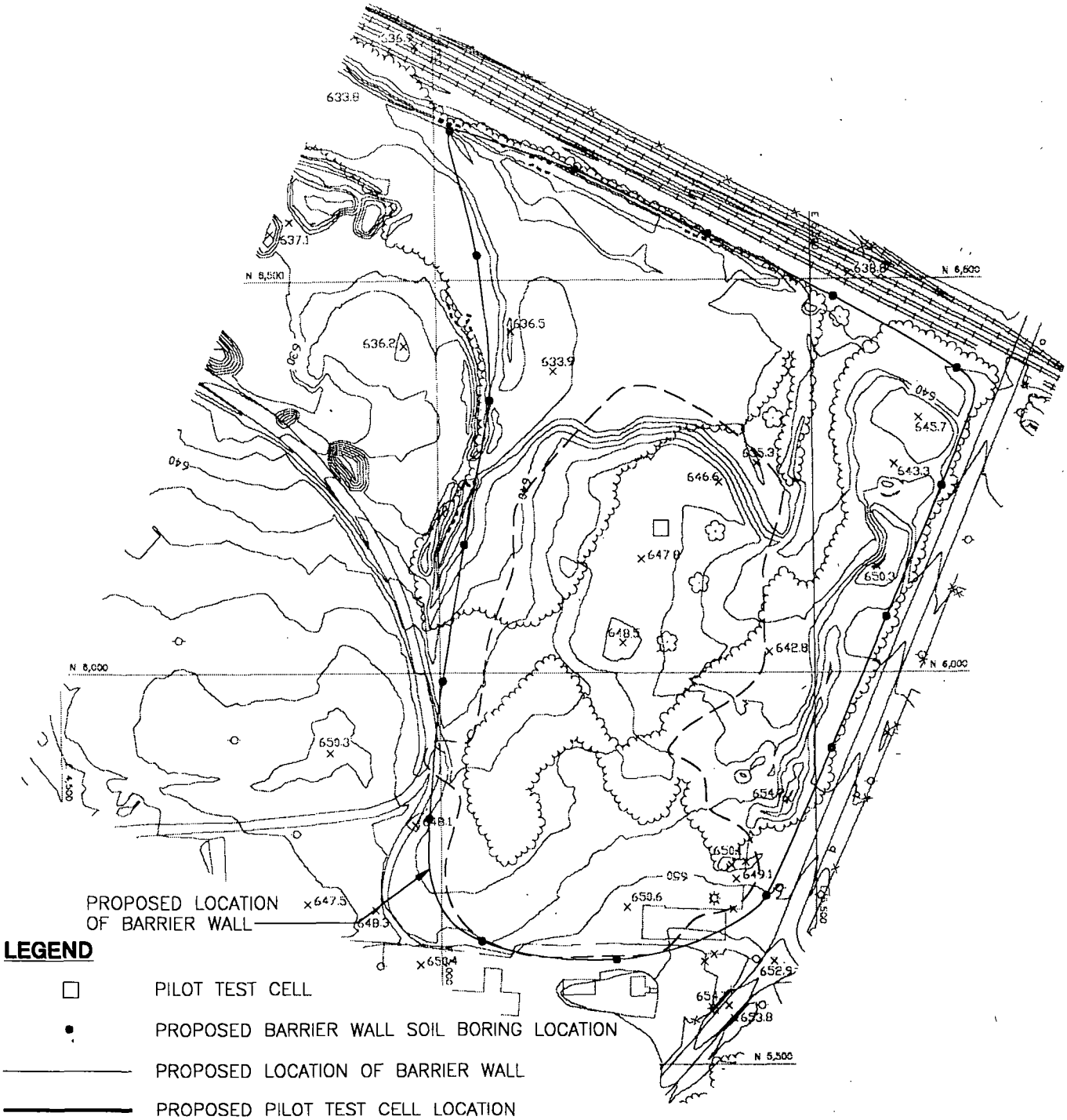
PROPOSED SOIL BORING LOCATION MAP-STILL BOTTOMS/TREATMENT LAGOON AREA

BARRIER WALL ALIGNMENT WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0110 **A3**

MONTGOMERY WATSON

QUALITY CONTROL: Graphic Standards — Lead Professional; Technical Review — Project Manager; Management Review — Other



LEGEND

- PILOT TEST CELL
- PROPOSED BARRIER WALL SOIL BORING LOCATION
- PROPOSED LOCATION OF BARRIER WALL
- PROPOSED PILOT TEST CELL LOCATION
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- APPROXIMATE EXTENT OF KNOWN SOIL CONTAMINATION

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.
3. FINAL BARRIER WALL LOCATION IS DEPENDENT ON RESULTS OF SOIL BORING PROGRAM.

north

0 200 400

SCALE IN FEET

FIGURE 4

Developed By PMS/DAP	Drawn By TPB	**PROPOSED SOIL BORING LOCATION MAP- OFF-SITE CONTAINMENT AREA**	Drawing Number 4077.0110 A4
Approved By M. HAMPER	Date 5-10-95	BARRIER WALL ALIGNMENT WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	MONTGOMERY WATSON
Reference			
Revisions REVISIONS PER USEPA COMMENTS DAP 7-31-95 TPB 7-31-95 LCL 8-8-95 & 8-10-95			

Management Review — Other

Technical Review — Project Manager

Graphic Standards — Lead Professional

QUALITY CONTROL

APPENDICES

A

SOIL BORING, TEST PIT AND AUGER PROBE LOGS

MONTGOMERY WATSON
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LOG OF TEST BORING
General Notes

EMPIRICAL CORRELATIONS WITH STANDARD PENETRATION RESISTANCE N VALUES *

	N VALUE * (BLOWS/FT)	CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS/SQ FT)
FINE GRAINED SOILS	0 - 2	VERY SOFT	0 - 0.25
	3 - 4	SOFT	0.25 - 0.50
	5 - 8	MEDIUM STIFF	0.50 - 1.00
	9 - 16	STIFF	1.00 - 2.00
	17 - 32	VERY STIFF	2.00 - 4.00
	>32	HARD	>4.00

	N VALUE * (BLOWS/FT)	RELATIVE DENSITY
COARSE GRAINED SOILS	0 - 4	VERY LOOSE
	5 - 10	LOOSE
	11 - 30	MEDIUM DENSE
	31 - 50	DENSE
	>50	VERY DENSE

* ASTM D 1586; NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 IN. O.D., 1 1/2 IN. I.D. SAMPLER ONE FOOT.

GRAIN SIZE TERMINOLOGY

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse	3/4" to 3"	3/4" to 3"
Fine	4.76 mm to 3/4"	#4 to 3/4"
Sand: Coarse	2.00 mm to 4.76 mm	#10 to #4
Medium	0.42 mm to 2.00 mm	#40 to #10
Fine	0.074 mm to 0.42 mm	#200 to #40
Silt	0.005 mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt/Clay	4-12%
Sedimentary Peat	12-50%
Fibrous and Woody Peat	More than 50%

RELATIVE PROPORATIONS OF COHESIONLESS SOILS

Proportional Term	Defining Range By Percentage of Weight
Trace	0% - 5%
Little	5% - 12%
Some	12% - 35%
And	35% - 50%

GENERAL TERMINOLOGY

Physical Characteristics - Color, moisture, grain shape, fineness, etc.
Major Constituents - Clay, silt, sand, gravel
Structure - Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin - Glacial, alluvial, eolian, residual, etc.

DESCRIPTION OF BORING LOG HEADINGS

No. = Sample number within the boring.
Rec. = Amount of sample recovery.
Moist = Visual estimate of the amount of moisture in the sample.
Type = Sampler type and sample interval.
N Value = The penetration resistance, N, is the sum of blows required to effect two successive 6" penetrations of the 2" split-spoon sampler per ASTM D1586.
Depth = Depth below ground surface.
Visual Classification = Lithologic symbol of soil or rock type; Description of stratigraphy; Borehole material graphics.
q_a = Penetrometer Reading, tons/sq. ft.
PID = Photoionization detector reading. Values are recorded as benzene equivalent units in ppm above background (0 = background reading).

Other environmental analyses may be reported. Results are provided as a value where quantifiable or as zero or ND when below detection limit.

SYMBOLS

SAMPLE TYPE

- Unsampled interval
- 2" outside diameter split spoon sampler
- 3" outside diameter split spoon sampler
- 3" Shelby tube
- 5' continuous sampler
- Drilled by hollow stem augers; not sampled; logged by cuttings
- Hand sample from surface
- 4" outside diameter core barrel sampler
- Drilled by rotary wash bore; not sampled; logged by cuttings

WELL GRAPHICS

- Concrete surface seal around well casing
- Bentonite slurry or cement-bentonite grout around well casing
- Bentonite pellet seal around well casing
- Fine filter sand backfill around well casing
- Sand backfill around well casing
- Sand filter pack around well screen
- Sand backfill or natural soil collapse in borehole
- Bentonite seal in borehole
- Gravel backfill around well casing
- Gravel backfill around vertical slot gas well
- Gravel backfill around a leachate well
- Gravel backfill around a perforated gas well
- Gravel base material

LABORATORY TESTS

W - Moisture Content, %
LL - Liquid Limit, %
PL - Plastic Limit, %
LI - Loss on Ignition, %
D - Dry Unit Weight, lbs./cu. ft.
pH - Measure of Soil Alkalinity or Acidity

DRILLING AND SAMPLING

RC - Rock Coring (Size)
RQD - Rock Quality Designator
RB - Rotary Boring
DM - Drilling Mud
CW - Clear Water
AR - Air Rotary
DC - Drove Casing (Size)
HSA - Hollow Stem Auger
FA - Flight Auger
HA - Hand Auger

WATER LEVEL MEASUREMENT

▽ - Water level at time shown
NW - No Water Encountered
WD - While Drilling
BCR - Before Casing Removal
ACR - After Casing Removal
AD - After Drilling

NOTE: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels.

MONTGOMERY WATSON
2100 Corporate Drive
Addison, Illinois
60101

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS

(More than 50% of material is larger than No. 200 sieve size.)

GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
	Gravels with Fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with Fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures

FINE-GRAINED SOILS

(50% or more of material is smaller than No. 200 sieve size.)

SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

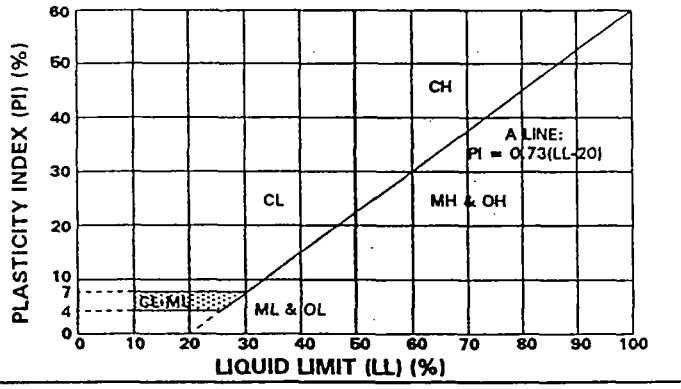
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} X D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} X D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent	GW, GP, SW, SP
More than 12 percent	GM, GC, SM, SC
5 to 12 percent	Borderline cases requiring dual symbols

PLASTICITY CHART



OTHER MATERIAL SYMBOLS

Topsoil	GS	SM/GM	CL-ML	Crystalline Rock	Dolomite
Pavement	GC-GM	SC/GC	Claystone	Sandstone	Siltstone
Fill					
Residual Material	GS2	SC-SM	Coal	Limestone	Shale

See log description for USCS classification of the following soils:
SM/GM & SC/GC - Symbols are used to differentiate SM, GM, SC & GC soils.

GS2 - Symbol used when approximately equal percentages of gravel, sand, silt & clay exist.
GS - Symbol used for GP, GW, SP or SW soils with nearly equal sand and gravel.

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Phase I RI/FS
Location: Griffith, Indiana

Boring No. SB-1
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Hon- tox
						FILL: Coarse Gravel		15.0			
1		18	M	21		FILL: Black cinder-like Fine to Medium Sand, Trace Gravel		30.0			
						Dark Gray Fine to Medium SAND					
2		20	M	23	5	Some Black Staining from 4 to 5'		35.0			
3		20	M	26		Becomes Brown Fine to Medium SAND at 7'					
					10	End Boring at 9'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Dry Upon Completion of Drilling
Time After Drilling Dry
Depth to Water
Depth to Cave in 8.5

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/1/89 End 8/1/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-2
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						FILL: Dark Gray (Some Gray and Purple Stained) Fine to Medium Sand, Trace of Drum Lids and Solid Paint Fragments, Trace of Silt.					
1		6	D	60	5			140.0			
2		20	D/W	25		Fill and Waste to 7'					
						Brown Fine to Medium SAND		70.0			
					10	End Boring at 8.5'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.5 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/1/89 End 8/1/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-2A
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth		qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Sandy Surface					
1		0				FILL: Brown Sandy Tried to collect a split spoon from 1-3' but had sample refusal, many drum lids at 1-2'		130.0			
2		0				Dark Gray Fine to Medium Sand with Trace of Silt and Paint Strong Odor, Attempt to sample at 3' and again at 4', both had spoon refusal (drum lids), decided to abandon hole and relocate. Two additional unsuccessful attempts, SB-2B and SB-2C		100.0			
					5						
						End Boring at 4'					
					10						
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Dry Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/1/89 End 8/1/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-3
Surface Elevation
Job No. 60251.03
Sheet 1 of 2

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Mono tox
						Well Vegetated Surface		0.0			
1		14	D/M	12		FILL: Brown Sandy Clay, Trace of Debris and Gravel		0.0			
					5	FILL: Black Sand, Trace to Some Clay, Trace Debris like glass, wood (burnt odor) plastic. Spoon Refusal at 4' Drill to 5'					
2		20	M	50				4.0			
						FILL: Brown Fine to Medium Sand. Various Debris and Waste encountered during sampling. Black (stained) rag stuck in tip of split spoon from 8'.					
3				17	10			10.0			
4		6	M	22				65.0			
5		18	W	38		Yellow granular resin-like substance collected from 12' Substance began to melt at the surface and had a pH of <1. Stained Sands (Gray, Dark Brown, and Purple) encountered at 14'		100.0			
					15						
6		16	W	93		Some Debris like stenciled paper, phone book pages, cardboard, paint solids, more yellow resin-like substance, and glass fragments. Fill and/or Waste to approx. 18'		200.0			
7		18	W	101		Gray Fine to Medium SAND which Grades into Gray Fine to Coarse SAND, Trace of Fine to Medium Gravel (Wet)					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 18' Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/2/89 End 8/2/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-3
Surface Elevation
Job No. 60251.03
Sheet 2 of 2

ONE PIERCE PLACE • SUITE 1110, ITASCA, ILL. 60143 • TEL(312) 773-8484

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth		qu (qa) (tsf)	Hnu	Explo-sive Gas	Field VOC Water	Mo: tox
						End Boring at 20'					
					25						
					30						
					35						
					40						

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-3A
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Crushed Stone and Sandy Surface					
						FILL: Dark Gray, Gray, and Brown Fine to Medium Sand. Trace of Silt and Clay. Several attempts to drive split spoon for soil samples. All unsuccessful due to obstructions and refusal. SB-3A and SB-3B are additional unsuccessful boring locations which were abandoned due to similar conditions of obstructive material near the surface. Field decisions were made to abandone the entire boring location for a test pit (TP-1). Relocate SB-3 to the Off-Site Containment Area.		3.0			
1		4	M/W	40				12.0			
					5	End Boring at 5'					
					10						
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 2.5 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/1/89 End 8/1/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-4
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Mor. to
						Vegetated Surface FILL: Black Silty Sand, Trace of Slag					
1		18	D	27		FILL: Brown and Black Silty Sand		2.0			
2		4	M	40	5	Spoon from 4-6' sample interval returns to surface covered with tar like substance. Open spoon to reveal poor recovery of brown sandy fill. Discover black liquid present inside hollow stem augers approximately 5' below ground surface. Innovate sampling device using a 4 oz jar taped to a tremmie pipe Collect sample of black liquid. Terminate boring.		8.0			
					10	End Boring at 6'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/1/89 End 8/1/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-4A
Surface Elevation
Job No. 60251.03
Sheet 1 of 2

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Straight drill to 10' at boring location 10' south of SB-4 Strong solvent-like odor		140.0			
1		0	W		10	Attempt sample interval at 10-12'. Spoon refusal, no sample. Continue drilling to 13'					
2		0	W		15	13-15' poor recovery. Solid paint and paint like resin (spongy). Continue drilling to 17'		100.0			
3		20	W	57		Traces of samples obtained during split spoon attempts revealed Dark Brown Silty Sand with Traces of Black Oily Waste, Orange and Blue Paint Pigments, and a Cloudy Liquid. Fill and/or Waste to 18'		190.0			
					20	Blueish (possible stained) Gray Fine to					

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0 Upon Completion of Drilling
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/10/89 End 8/10/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-4A
Surface Elevation
Job No. 60251.03
Sheet 2 of 2

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SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth		qu (qa) (tsf)	Hnu	Explosive Gas	Field VOC Water	Monc tox
						Medium SAND.					
						End Boring at 20'					
					25						
					30						
					35						
					40						

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-5
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Well Vegetate Surface					
1		16	D	42		FILL: Black to Brown Fine to Medium Sand, Trace of Silt and Fine Gravel		7.0			
2		0	W		5	Solvent-like odor		4.0			
3		18	W	50 /3"				8.0			
4		4	W	60	10	FILL: Black-Dark Gray Silty Sand, Some Debris like paint, rags, plastic, sludge, oily		120.0			
5		18	W	85				100.0			
6		18	W	29	15	Brown Fine to Coarse SAND, Trace to Little Fine to Coarse Gravel, Trace of Silt		80.0			
					20	End Boring at 17'					

WATER LEVEL OBSERVATIONS

While Drilling ▽ 7.0 Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/3/89 End 8/3/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-6
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Hc t
						FILL: Black to Brown Fine to Medium Sand					
1		18	D	26				3.0			
2		12	D/M	78	5	Spoon refusal at 5.5', sample reveals Brown Fine to Medium Sand to 5', then distinctive color change to black at 5.7', strong solvent/glue-like odor, moist		210.0			
3		2	W	100 /5"		Poor Recovery, strong solvent odor with black heavy oily sheen in water, trace of solid paint pigment and cardboard waste to 11.5'		225.0			
					10	Black wet silty sandy fill with trace of paint, oil, foam, wood from 11.5' to 15'					
4		22	W	44				150.0			
						Brown-Gray Silty Fine to Coarse SAND, Trace to Little Fine to Coarse Gravel					
5		10	W	23				80.0			
					15	End Boring at 15'					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0 Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/3/89 End 8/3/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-7
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						FILL: Brown Fine to Medium Sand, Trace of Silt and Fine to Coarse Gravel					
1		14	M	100	5	Black Silty Sand at 5', Possible Staining, Moist to Wet		80.0			
2		0		65		No recovery, continue drilling to 8'					
3		0		21		No recovery and spoon wet with solvent odor, continue drilling to 10'		25.0			
4		0		90	10	No recovery, strong solvent odor, attempt sample again at 12-14' interval		90.0			
5		1		2				130.0			
6		14	W	31	15	Poor recovery, apparent waste material, recovery revealed black sludge-like substance with strong odor and oil sheen FILL to 15'		90.0			
						Good revoery, Dark Brown to Gray (some heavy oily staining) Fine to Coarse Sand with Fine to Coarse Gravel, Trace of Pebbles, Wet					
7		18		50 /4"				150.0			
					20	End Boring at 16'					

WATER LEVEL OBSERVATIONS

While Drilling ▽ 7.0 Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/4/89 End 8/4/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-8
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth		qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Straight drill to 4'					
1		18	W	12		Brown Fine SAND, Trace of Silt					
					5	Black Fine to Coarse SAND and GRAVEL, Slight Odor.		6.5			
						Black to Dark Gray Fine to Medium SAND, Trace of Fine Gravel.		14.0			
						Grades into Gray Fine to Medium SAND, Trace of Silt and Fine Gravel.					
					10	End Boring at 10'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 3.8 Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/8/89 End 8/8/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-9
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Sandy Surface Straight drill to 2', collect 3" spoon at 2-4'					
1		18	M	23		Brown Fine SAND, Trace of Medium Gravel at 4'		1.0			
2		18	M/W	9	5	Brown Fine to Medium SAND, Trace of Fine to Medium Gravel.		0.0			
3		18	W	49							
					10	Gray Silty SAND Layer, Trace of Silty Clay Gray-Dark and Gray Laminated		20.0			
						Brown-Gray Medium to Coarse SAND, Some Fine Gravel					
						End Boring at 10'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 4.0 Upon Completion of Drilling
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/8/89 End 8/8/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-9A
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth		qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monc tox
						Sandy Surface Straight drill to 4', collect first spoon from 4 to 6'					
1		18		26	5			14.0			
						Split spoon sample revealed wet Gray SAND, decide to abandon hole because of low HNu readings and no obvious waste interval, relocate approximately 50' east.					
					10	End Boring at 8.0'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 4.0 Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/8/89 End 8/8/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-10
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Sandy Surface					
1		18	M	26		Brown Fine SAND, Trace to Little Fine to Medium Gravel at 3'					
						Grades into Brown to Gray Fine to Coarse SAND, Trace of Fine Gravel and Silt.		9.0			
2		24	M/W	9	▽	Wet at 3.5', Strong Solvent-like Odor		180.0			
					5						
3		18	W	4				150.0			
4		18	W	23				110.0			
					10	End Boring at 10'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 3.5 Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/9/89 End 8/9/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-11
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Hor to
						FILL: Sand and Gravel Surface					
1		24	M	15		Dark Brown to Brown Fine SAND, Trace of Silt		3.0			
2		24	M	19		Brown to Gray Fine SAND, Some Mottling at 4'		20.0			
					5						
3		24	W	36		Brown-Gray Fine to Coarse SAND, Trace to Little Fine to Coarse Gravel Trace of Silt at 8'		170.0			
4		24	W	43		Brown-Gray Fine SAND, Trace of Coarse Sand and Fine Gravel		35.0			
					10	End Boring at 10'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 3.5 Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/9/89 End 8/9/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-12
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Sandy Surface					
1		24	M	24		Dark Brown to Brown Fine SAND, Trace of Silt		10.0			
2		24	M	21		Brown Fine SAND		200.0			
					5	Black and Dark Gray (Some Stained) Fine to Medium SAND at 4.5 to 4.8'					
3		20	W	8		Brown and Gray Fine to Coarse SAND and GRAVEL, Trace of Silt		190.0			
4			W	38				140.0			
					10	End Boring at 10'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.5' Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/9/89 End 8/9/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-13
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Mon. to
						FILL: Road Gravel					
1		20	M	48		Dark Brown to Brown Fine SAND, Trace Silt.		150.0			
2		20	M/W	14				10.0			
					5	Black and Gray to Brown Fine to Coarse SAND, Trace Gravel.					
4		22	W	33		Trace of Layered Staining at 7'		20.0			
5		22	W	41		Gray Fine to Coarse SAND, Little Fine Gravel.		40.0			
					10	End Boring at 10'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 4.5' Upon Completion of Drilling
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/9/89 End 8/9/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-14
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N	SAMPLE Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES HNu	SOIL PROPERTIES Explosive Gas	SOIL PROPERTIES Field VOC Water	SOIL PROPERTIES Monotox
						Brown Fine to Medium SAND					
						Grades into Gray Fine to Medium SAND at 3'					
1				117	10			80.0			
						End Boring at 12'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 9/6/89 End 9/6/89
Driller ETI Chief KKT Rig D 50
Logger TWP Editor TJM
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-15
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth		qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Act
						Grades into Gray Fine to Medium SAND at 2'					
					5						
						Solvent-like Odors					
1		24		22	10						
						Possible Fill Material Present		130.0			
						Reddish Brown and Black Staining.					
						End Boring at 14'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 9/6/89 End 9/6/89
Driller ETI Chief KKT Rig D 50
Logger TWP Editor TJM
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-16
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Brown Fine to Medium SAND					
1		15		13	5	Grades into Brown and Gray Fine to Medium SAND, Trace Coarse Sand.		140.0			
						End Boring at 7'					
					10						
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 9/6/89 End 9/6/89
Driller ETI Chief KKT Rig D 50
Logger TWP Editor TJM
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-17
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	SAMPLE Type	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa)	SOIL PROPERTIES HNu	SOIL PROPERTIES Explosive	SOIL PROPERTIES Field VOC	SOIL PROPERTIES Hc
						Gray Fill to Medium SAND					
1		15		29	5	Black and Gray Staining between 4 and 5'		60.0			
						Reddish Brown color at 7'					
						End Boring at 8'					
					10						
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 9/6/89 End 9/6/89
Driller ETI Chief KKT Rig D 50
Logger TWP Editor TJM
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-18
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Brown Fine to Medium SAND					
						Black at 1'					
1		18		29	5	Grades back into Brown Fine to Medium SAND, Trace Gravel		45.0			
						End Boring at 8'					
					10						
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 9/6/89 End 9/6/89
Driller ETI Chief KKT Rig D 50
Logger TWP Editor TJM
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB20
Surface Elevation 639.0
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						Straight Drill to 5' Cuttings: Black and Dark Gray Silty		
1		24	M	10	5	Black and Dark Brown Fine to Medium SAND, Trace to some Peat and Organics at 5-6'		210 80 25
						End of Boring 7.0 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 7.0 Upon Completion of Drilling ▼
Time After Drilling
Depth to Water 7.0
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/8/90 End 5/8/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

MONTGOMERY WATSON

LOG OF TEST BORING

Project: **American Chemical Services**
Still Bottoms/Treatment Lagoon
Location: **Griffith, Indiana**

Boring No. **SB24**
Surface Elevation **646.6**
Job No. **20007001**
Sheet **1** of **1**

2100 Corporate Drive, Addison, Illinois 60101, TEL. (708) 691-5000

SAMPLE No.	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)	pH
					0	Grassy Surface of Off-Site Containment Area Straight Drill to 9.5' Cuttings: (0-5') FILL: Black and Brown Sandy Clay, Dry and Loose			
					5 ▽				
					10				
	■	6		12		Buried Objects and Waste From 5-18'. Log of Material from Waste Sample at 11-13' Mostly Waste; Wet, Dark Gray and Black Sandy Clay Matrix with Paint-Like Solids. Various Colors of Blue, Green, and Purple. Trace of Plastic Bags, Metal Debris and Paper. Water has Oily Sheen. Continue Straight Drill to 19'			
					15				
	■	24		94	20	Native Material at 18'. Brown Fine to Medium SAND, Trace Fine to Medium Gravel			
						End of Boring at 21.0 Feet Borehole Backfilled with Bentonite Holeplug			
					25				
					30				
					35				
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ **7.0** ft. Upon Completion of Drilling ▼ ____ ft.
Time After Drilling ____
Depth to Water ____
Depth to Cave in ____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **5/9/90** End **5/9/90**
Driller **ETI** Chief **KKT** Rig **D-50**
Logger **TJM** Editor **SJB**
Drill Method **4.25" ID HSA**

ID: PS-JKP

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB25R
Surface Elevation 645.6
Job No. 60251.12
Sheet 2 of 2

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)
3		18	M	40		Gravel. Decreased Silt		
						Grades into Gray Silty CLAY, Trace Fine Sand and Fine Gravel at 28'		10
					30	End of Boring at 29.0 Feet Borehole Backfilled with Bentonite Holeplug		
					35			
					40			
					45			
					50			
					55			

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB26
Surface Elevation 647.2
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	Type	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
					5	Straight Drill to 9' Encountered Metal Objects (possible drums) at 2' Below Ground. Saturated with Thin Black Liquid		100
1		12	W	10	10	FILL: Brown Fine Sand, Mostly Saturated Oily Liquid, Trace Wood and Twigs		85
					15			
2		18	W	51	20	Gray and Brown Fine to Medium SAND, Trace Fine Gravel (slight dark staining)		30
					25	End of Boring at 21.0 Feet Borehole Backfilled with Bentonite Holeplug		

WATER LEVEL OBSERVATIONS

While Drilling ▽ UNK Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/9/90 End 5/9/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB26R
Surface Elevation 647.2
Job No. 60251.12
Sheet 1 of 2

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
						Redrill at SB26 Straight Drill through Bentonite Backfill to 24' Refer to SB26 Log for Stratigraphic Details 0-24'		
					5			
					10			15
						FILL: Dark Brown (looks oily stained) Sand, Moist/Wet		
					15			
					20			150
1		18	W	26	25	Brown and Gray Fine to Medium SAND, Trace Silt Seams at 25.5' - 26.0' (1/4"), Trace Oily Sheen in Wet Sand and Brownish Oil-Like Staining		40

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/6/90 End 6/6/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB26R
Surface Elevation 647.2
Job No. 60251.12
Sheet 2 of 2

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES	
No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)		qu (qa) (tsf)	PID (ppm)
						End of Boring at 26.0 Feet Borehole Backfilled with Bentonite Holeplug		
					30			
					35			
					40			
					45			
					50			
					55			

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB27
Surface Elevation 644.5
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
					0	Straight Drill to 9'		
						Cuttings: FILL: Black and Dark Gray Sandy Clay		
						Encountered Buried Objects at 2.5'-3'		
					5			
1		18	M/W	11	10	FILL: Brown Sand and Gravel Matrix with Various Waste Materials such as Black Oily Liquids, Solid Paint-Like Solids, Stained Sand, Pebbles, and Twigs		90
					15			
						Continue Drilling to 19'		
2		24	W	46	20	Brown, Gray, and Dark Gray Fine SAND, Trace Medium Sand, Trace Medium Sand and Fine Gravel, Some Black Staining Throughout		44
						End of Boring at 21.0 Feet		
						Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 3.0 Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/10/90 End 5/10/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB27R
Surface Elevation 644.5
Job No. 60251.12
Sheet 1 of 2

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	SAMPLE Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
					5	Redrill at SB27 Straight Drill through Bentonite Backfill to 24' Refer to Log SB27 for Stratigraphic Details 0-24'		
					10			
					15			
					20	Abandoned Borehole Due to Poor Sample Recovery on Several Attempts. Relocate Borehole to SB27RR and Attempt Sampling for Sand above Clay Sample.		20
					25	End of Boring at 26.0 Feet		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling ▼ _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/6/90 End 6/6/90
Driller ETI Chief TJC Rig D-5
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB27R
Surface Elevation 644.5
Job No. 60251.12
Sheet 2 of 2

2100 CORPORATE DRIVE · ADDISON, ILLINOIS 60101 · TEL (708) 691-5000

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES	
No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)		qu (qa) (tsf)	PID (ppm)
					30	Borehole Backfilled with Bentonite Holeplug		
					35			
					40			
					45			
					50			
					55			

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB27RR
Surface Elevation 644.3
Job No. 60251.12
Sheet 1 of 2

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						Move SB27R(R) 5' North and Redrill Straight to 22'		
						FILL: Black and Brown Silty Fine Sand, Trace of Oily-Like Staining (Drillers Notes: possibly encountered buried objects at 4' and again at 7')		
					5			
					10			
					15			
					20			
1		16	W	21		Brown Fine to Medium SAND, Trace of Oily Staining		150
								70
						Gray SILT Layer (1/2"), Trace Clay		25
					25	Gray Fine to Medium SAND with Intermitten Gray Silt and Clayey Silt		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling ▼ _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/7/90 End 6/7/90
Driller ETI Chief TJC Rig D-5(
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB27RR
Surface Elevation 644.3
Job No. 60251.12
Sheet 2 of 2

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES	
No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)		qu (qa) (tsf)	PID (ppm)
						Layers (1/4" to 1")		
						End of Boring at 24.0 Feet Borehole Backfilled with Bentonite Holeplug		
					30			
					35			
					40			
					45			
					50			
					55			

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB28
Surface Elevation 645.9
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)
						Straight Drill to 2'		
1		4	W	4		FILL: Mostly Refuse Saturated with Black Thick Liquids. Various Cloth, Wood, and Fibrous Material Throughout		60
					5			
2		8	W	9		FILL: Light Brown Clay and Sand Mixed with Black Oily Liquid and Sludge Like Material. Traces of Gravel, Wire, and Twigs		80
					10	End of Boring at 8.0 Feet Borehole Backfilled with Bentonite Holeplug		
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 2.0 Upon Completion of Drilling ▽
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/10/90 End 5/10/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB29
Surface Elevation 647.3
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)
						Straight Drill to 2'		
1		3		44		FILL: Refuse Consisting of Plastic, Paper, Grass Clippings, Wood, and Metal Debris.		5
					5			
2		20		65		FILL: Greenish-Gray to Brown Silty Clay, Trace of Fine Gravel and Twigs, Slight Trace of Oily Waste in Fractures		55
						End of Boring at 8.0 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 2.0 Upon Completion of Drilling ▽
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/10/90 End 5/10/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB30
Surface Elevation 646.3
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
						Straight Drill to 8'		
						FILL: Brown and Black Sand, Trace to Some Debris such as wood, paper and plastic bags		15
1		20	M	27	5	FILL: Dark Blue Thick Paint-Like Rubbery Liquid, Some Grayish-Blue Sludge, Trace Oily Brown Liquid, Heavy Solvent-Like Odors		250
					10	FILL: Brown Sand and Gravel, Heavy Solvent-Like Odor		
						End of Boring at 10.0 Feet Borehole Backfilled with Bentonite Holeplug		
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling ▼ _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/11/90 End 5/11/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
RI/FS Phase II
Location: Griffith, Indiana

Boring No. SB30A
Surface Elevation 646.0
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	SAMPLE Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
						Straight Drill to 8'		
						Cuttings:		
						(0-2') Black Sandy Fill, Trace Debris (cloth and plastic bags)		150
					5	(3-6') Dark Purple Sandy Fill (stained), Trace of Metal Debris		
						(6-10+) Brown to Brown Fine Sand Fill		230
1		1	M	59		No Recovery - Drill to 10' and Attempt to Sample but Plug Stuck in Lead Auger. Pull Entire String of Augers and Decide to Abandoned Boring and Relocate 5' East AP58		
					10			
						End of Boring at 10.0 Feet		
						Borehole Backfilled with Bentonite Holeplug		
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/11/90 End 5/11/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB31
Surface Elevation 648.5
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1		18	M	18		Break Ground 6" Below Surface, Pound 2" SPT to 2'		
						FILL: Dark Brown and Dark Gray Sand and Gravel		6
					5	End of Boring at 2.0 Feet		
						Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼

Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/11/90 End 5/11/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB32
Surface Elevation 647.0
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1		18	M	55		Break Ground 6" Below Surface, Pound 2" SPT to 2.5'		
						FILL: Black, Dark Gray, Dark Brown Sand and Gravel, Trace Coarse Gravel and Debris, Slight Trace of Stained Sand		10
					5	End of Boring at 2.0 Feet		
						Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/11/90 End 5/11/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB33
Surface Elevation 646.3
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1		12	M	54		Break Ground 6" Below Surface, Pound 2" SPT to 2.0'		
						FILL: Black Sandy and Gravel, Trace Coarse Limestone Gravel and Debris		7
						SPT Refusal at 2', spoon bounced probably rubber object buried		
					5	End of Boring at 2.0 Feet		
						Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/11/90 End 5/11/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB59
Surface Elevation 638.4
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	Type	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						FILL: Crushed Stone Road Gravel FILL, Gray Fine to Medium Sand, Trace Silt		
						Gray Fine to Medium SAND, Trace Silt		
					5			
1		14	W	13		Grades to Dark Brownish Gray Fine to Coarse SAND, Trace to Some Fine to Coarse Gravel, Trace Silt and Cobbles, Thin Black Stained Layers at 6.5' and 6.9' (1/4"), Odorous		20
					10			
2		12	W	25	15	Becomes Dark Gray Fine to Medium SAND, Trace Coarse Sand and Fine Gravel, Hint of Black Staining Throughout		8
						End of Boring at 16.0 Feet Borehole Backfilled with Bentonite Holeplug		
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 4.0 Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/20/90 End 6/20/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB60
Surface Elevation 638.0
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)
						Straight Drill to 5.5'		
						FILL: Crushed Stone Road Gravel		
						Brown and Gray Fine SAND		
					5			
1		14	W	10		Becomes Brown and Gray Fine to Coarse SAND, Trace Silt and Fine to Coarse Gravel, Odorous		120
						Continue Drilling to 14.5'		
					10			
2		10	W	40	15	Becomes Dark Gray Fine to Coarse SAND and GRAVEL, Trace Silt and Pebbles, Traces of Black Staining Throughout		30
						End of Boring at 16.0 Feet		
						Borehole Backfilled with Bentonite Holeplug		
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 4.5 Upon Completion of Drilling ▽
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/20/90 End 6/20/90
Driller ETI Chief TJC Rig D-5
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB61
Surface Elevation 636.8
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
						Brown Sand FILL		
						Brown Fine to Medium SAND, Trace Silt and Fine Gravel		
						Wet at 3.5'		
					5			
1	■	4	W	21		Brown to Black Fine to Medium SAND, Odorous with Staining, Oily Sheen on Water		35
						Trace Coarse Cobble		
						Becomes Black (mostly stained) Fine to Coarse SAND and GRAVEL, Trace Pebbles, Strong Odor		
					10			
2	■	14	W	37		Grades to Gray Fine to Medium SAND, Trace Coarse Sand and Fine Gravel to 15.0		25
					15			
						Gray Silty CLAY, Trace to Little Fine to Medium Sand, Trace Fine to Coarse Gravel		
					20	End of Boring at 16.0 Feet Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 3.5 Upon Completion of Drilling ▽
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/20/90 End 6/20/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB62
Surface Elevation 637.1
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)
						Brown Fine to Coarse SAND, Trace Silt and Pebbles		
					5			
1		15	W	5		Grades to Gray Fine to Coarse SAND, Trace to Little Fine to Medium Gravel, Slight Odor, Trace Silt		40
					10			
2		14	W/M	51	15	Grades to Brown and Gray Fine to Medium SAND, Trace to Some Coarse Sand and Fine Gravel		50
								0.5
						Dense Gray Silty CLAY, Trace Fine Sand and Fine Gravel, Moist		
					20	End of Boring at 16.0 Feet Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 4.0 Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/20/90 End 6/20/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
RI/FS Phase II
Location: Griffith, Indiana

Boring No. SB63
Surface Elevation 637.1
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
					0	Brown Fine SAND, Color Change to Dark Gray Fine to Medium Sand, Trace Gravel		
					5	Becomes Gray Fine to Coarse SAND, Trace Fine to Medium Gravel, Black Oily Stained Layer at 4.7' (1/2"), Interbedding of Fine to Coarse Sand Layers		
1		16	W	27				105
					10	Brownish-Gray Fine to Medium SAND, Trace Fine Gravel		
2		16	W	47	15			20
						Gray Silty CLAY, Trace to Some Fine to Medium Sand and Fine Gravel (thin sand seams at top of clay, 1/4 to 1/2" thick) Clay Becomes More Dense with Depth, Trace Fine to Coarse Gravel		
					20	End of Boring at 15.5 Feet Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 4.0 Upon Completion of Drilling ▽
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/21/90 End 6/21/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB64
Surface Elevation 637.4
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
						Brown to Gray Fine SAND		
					5			
1		8	W	4		Dark Gray and Black Fine to Coarse SAND, Trace to Little Fine to Coarse Gravel, Wet with Strong Odors Continue Drill to 14.5'		110
					10			
2		18	W	50	15	Becomes Brownish-Gray Fine to Coarse SAND, Trace Fine to Coarse Gravel, Trace Silt at 15.5-16.0'		18
						End of Boring at 16.0 Feet Borehole Backfilled with Bentonite Holeplug		
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 4.0 Upon Completion of Drilling ▽
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/21/90 End 6/21/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB65
Surface Elevation 637.7
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						FILL: Crushed Stone Road Gravel		
						Brown Fine SAND		1.0
1		16	W	27	5	Grades to Dark Gray and Black Fine to Coarse SAND, Trace to Some Fine to Coarse Gravel, Trace Cobbles, Blackish Staining Throughout to 6.7', Then Gray Fine Sand, Trace Thin Silt Seam at 6.8' (1/4")		40
2		14	W	37	10			
					15	Becomes Gray Fine SAND with Alternating Layers of Gray SILT and Gray Fine SAND (1/2" each)		3
						End of Boring at 16.0 Feet Borehole Backfilled with Bentonite Holeplug		
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 4.5 Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/21/90 End 6/21/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB66
Surface Elevation 637.8
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Hoist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						Crushed Stone Road Gravel		
						Brown Fine SAND		0.0
					5			
1		48	W	7		Brown Fine to Coarse SAND, Grades Coarse to Trace Fine to Coarse Gravel		1.0
						Gray Fine to Coarse SAND, Trace Fine to Medium Gravel, Wet with Odor, Trace Black Staining Throughout Continue Drilling to 14.5'		
					10			
2		14	W	37	15	Gray Fine SAND, Trace Silt, Laminated with Horizontal Banding of Gray and Dark Gray		1.0
						Gray SILT Layer, Trace Clay		
						Gray Fine SAND, Trace to Little Silt		
					20	Dense Gray Silty CLAY, Trace Fine Gravel Trace Fine to Coarse Sand and Gravel on Top of Clay		
						End of Boring at 16.0 Feet Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 4.0 Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/21/90 End 6/21/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB67
Surface Elevation 637.4
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
						FILL: Crushed Stone and Sand Fill Roadway.		
						Brown Fine SAND to Dark Gray Fine to Coarse SAND		
					5			
1		14	W	15		Becomes Dark Gray to Jet Black, Fine to Coarse SAND, Trace to Some Fine Gravel, Odorous		5.0
						At 6.8' Grades to Dark Gray to Gray Fine SAND, Trace to Little Medium Sand, Trace of Silt and Fine Gravel at 6.9'		
					10			5.5
2		16	W	58	15	Becomes Gray Fine to Medium SAND, Trace Fine Gravel, Moist		
						Gray Silty CLAY, Trace Fine Gravel		
						Grades into Brownish-Gray Silty CLAY, Trace to Little Fine to Medium Sand, Less Dense		
					20			
						End of Boring at 16.0 Feet Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/21/90 End 6/21/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB68
Surface Elevation 637.0
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	Type	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						Sandy Fill on Surface		
						Straight Drill to 5.5'		
1		8	W	9	5	Brown Fine to Medium SAND to 5.7' then Black and Dark Gray Fine to Coarse SAND, Trace Fine Gravel, Black Staining and Odor Throughout		13.0
						Continue Drill to 14.5'		
					10			
2		18	W	40	15	Grades to Gray Fine to Medium SAND, Trace Fine to Medium Gravel to 14.6'		9.0
						Gray Silty CLAY, Trace Fine to Medium Sand and Fine Gravel, Trace Fine to Medium Sand Seams (1/2") at 15'-15.5' Grades to Gray Silty CLAY, Trace to Little Fine to Coarse Sand and Fine Gravel, Increasingly Sandy with Depth		
					20	End of Boring at 16.0 Feet Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/22/90 End 6/22/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
RI/FS Phase II
Location: Griffith, Indiana

Boring No. SB69
Surface Elevation 638.3
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	Type	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
					0	Crushed Stone Surface Fill		
						Dark Gray (some stained) Fine SAND with Solvent Odors to 3.5', then Brown Fine SAND		
						Straight Drill to 6.5'		100
					5			
1		18	W	32		Brown (much oily stained) SAND and GRAVEL (possible fill), Trace to Some Fine to Coarse Gravel and Pebbles, Trace Silt, Wet at 6.5-7.0', Black Staining on Fine Sand at 6.5-6.8'		150
					10			
					15			
						Continue Drilling to 20'		
2		12	W	30	20	Gray Fine to Coarse SAND, Trace Silt that increases with depth		75
								5.0
						Becomes Gray SILT and Fine SAND (layers) at 21.1', Trace Gray Clay		
					25	End of Boring at 21.5' Feet Borehole Backfilled with Bentonite Holeplug		

WATER LEVEL OBSERVATIONS

While Drilling ▽ 5.0 Upon Completion of Drilling ▽
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/25/90 End 6/25/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB70
Surface Elevation 638.8
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
					0	Road Gravel Surface		
						Brown and Dark Gray Silty Fine SAND (possible Fill), Trace Fine to Coarse Gravel, wet at 5-6'		
						Straight Drill to 6.5'		
					5 ▽			70
1		10	W	42		Brown and Dark Brown (stained) Fine to Coarse SAND and Fine to Medium Gravel, Trace Silt and Oily Staining (some in tiny droplets) throughout		120
					10			
					15			
2		14	W	35	20	Becomes Gray Fine to Coarse SAND, Trace Fine Gravel, Trace of Gray Silty Clay Pocket at 20'		15.0
						End of Boring at 20.5 Feet		
						Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 5.0 Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/25/90 End 6/25/90
Driller ETI Chief TJC Rig D-5(
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB71
Surface Elevation 638.7
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
						Road Gravel Surface Underlain by FILL: Brown Silty Fine Sand and Gravel to Black Silty Fine Sand, Trace Gravel		
					5	Brown to Dark Brown Silty Fine SAND which Grades to Brown and Gray (much darker with Black Oily Stains) Fine to Coarse SAND and Fine Gravel, Trace of Fine Sand which Increases with Depth. Continue Drilling to 19'		
1		16	W	7				90
					10			
					15			
2		14	W	32	20	Gray Fine to Medium SAND, Trace Coarse Sand and Fine Gravel, Trace Silt Layers at 19.2' and 20.2' (1/4" to 1/2") Increasingly Finer Grained Sand with Depth		25
						End of Boring at 20.5 Feet Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0 Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/27/90 End 6/27/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB72
Surface Elevation 638.4
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)
						Crushed Stone Road Gravel Surface Underlain by FILL: Brown Fine Sand to Dark Gray Fine Sand		
					5	Straight Drill to 6.5'		
1		10	W	6		Brown Fine SAND which Grades into Gray Fine to Medium SAND at 6', Trace Silt, Increasing Coarse Sand to Trace Fine Gravel Wet with Slight Oily Sheen Continue Drilling to 19'		17
					10			
					15			
2		14	W	23	20	Gray Fine to Coarse SAND, Trace Fine to Medium Gravel, Trace Silt with Depth, Thin Silt Layer (1/2") at 20.3', Trace Clayey Silt Pockets at 19.9', Silt Layers Interbedded with Fine to Coarse Well Sorted Sand		50
						End of Boring at 20.5 Feet Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 5.5 Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/28/90 End 6/28/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB73
Surface Elevation 641.7
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)
						Gravel Surface Crushed Stone Underlain by FILL: Brown to Dark Gray and Black Silty Fine Sand with Strong Solvent Odors		
1		16	M	4	5	FILL: Brown, Dark Brown, and Black (staining throughout) Silty Fine Sand, Trace of Wood and Gravel		70
					10	Estimate Fill to 9.5'		
2		18	M/W	54	15	Gray and Dark Gray Fine SAND (slight trace of black staining), Trace Silt (increases with depth), Trace to Little Silt in thin layers (1/4") at 18.5-19.0, tip of spoon reveals black stained layer directly above Silty Clay Layer at 19.0'		35
					20	End of Boring at 19.0 Feet Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/28/90 End 6/28/90
Driller FTI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB74
Surface Elevation 641.6
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	Type	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						Road Gravel Surface Underlain by FILL: Brown and Dark Gray Silty Fine Sand, Trace of Dark Staining		6
1		16	M/W	5	5	Brown Fine Sand, Trace Silt and Black Staining Throughout Driller's Note: Encountered Buried Object While Drilling at 11' (possible drums)		20
					10	Estimate Fill to 12'		
2		10	W	63	15	Brown and Dark Gray Fine SAND, Trace Black Oily Staining Throughout, Trace Silt at 18.5-19.0'		
					20	End of Boring at 19.0 Feet Borehole Backfilled with Bentonite Holeplug		85
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/28/90 End 6/28/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB35
Surface Elevation 638.0
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
						Sandy FILL On Mounded Surface Approximately 15' North-Northeast of TP-2		
						Straight Drill to 15'		
					5	FILL: Brown Fine to Coarse Sand		
					10			150
1		18	M	32	15			240
								80
						Brown and Gray Fine to Coarse SAND and GRAVEL		40
						Grades to Gray Silty Fine to Coarse SAND at 16.1' to 16.4'		
					20	Gray Silty CLAY, Trace to Little Fine to Medium Sand, Trace Gravel, Moist		
						End of Boring at 17.0 Feet		
						Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 5/8/90 End 5/8/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB36
Surface Elevation 647.1
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)
						Straight Drill to 8.5 Feet		
					5			<1.0
						Encountered Refuse such as wire, bed-springs, and cloth in a Silty Sand Matrix		150
1		18	M	12		Cuttings from 7-8' Moist to Wet, and Black with Slight Oily Appearance		50
					10	WASTE: Orangish-Brown, Tarry Substance, Very Cohesive and Gummy, Trace of Grayish-Purple Clay and Debris		
					15			
2		12	W	19		Black and Dark Gray (mostly oily stained) Medium to Coarse SAND and Fine to Coarse Gravel, Some Oily Substance in Silt at 16' to 17'		170
					20			
						Grades to Brown and Gray Fine to Coarse SAND, Trace to Little Fine to Coarse Gravel, Trace of Oily Staining at 22'		
3		10	W	27				70
					25	End of Boring at 23.5 Feet Borehole Backfilled with Bentonite Holeplug		

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/7/90 End 6/7/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB37
Surface Elevation 648.6
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						Straight Drill to 8.5' Log Based on Cuttings: (0-3') FILL: Black and Brown Silty Sand (3-7') Buried Objects Encountered While Drilling Through Fill		
1		2	M	68	10	Log of Spoon Sample: WASTE and FILL: (8.5-8.7') Black Rubbery Solid Waste, Trace to Some Tarry Solids Incorporated in Rubbery Solid (possible layers) (8.7-9.0') Dark Purple Paint-Like Solid Mixed in a Sand and Gravel Matrix (mostly consolidated) (9.0-10.0+) Black (stained) Fine to Medium Sand, Trace Silt, Possible Cinders and wood and paint solids Debris Estimate FIll to 12.5'		50
2		16	W	32	15			90
					20	Continue Drilling to 15.5' Brown and Gray, Fine to Medium SAND, Trace to Some Brown and Black Oily Saturation, Trace Roots. Continue Drilling to 22'		
3		16	W	53		Grayish-Brown Fine to Medium SAND, Trace Silt.		20
					25	End of Boring at 23.5' Borehole Backfilled with Bentonite Holeplug		

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/8/90 End 6/8/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB38
Surface Elevation 647.0
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						Straight Drill to 8.5'		0
1		8	W	70	10	FILL and REFUSE: Metal Scrap and Wire, Trace of Paper and Plastic in a Black Clayey Sand Matrix		150
2		3	W	23	15	Poor Recovery of FILL: Light Brown Sandy Clay with Traces of Black and Dark Brown Oily Staining, Trace Metal Fragments. Slight Rubbery and Sticky Texture, Trace Fine to Coarse Sand and Gravel. Estimate Fill to 17'		100
3		16	W	60	20	Continue Drilling to 18.5' Brown to Fine SAND, Trace to Some Medium to Coarse Sand and Gravel, Trace to Little Silt, Trace Oily Staining		55
4		14	W	93	25	Grades to Brown Fine to Medium SAND at 22', Trace to Little Silt		65
						End of Boring at 23.5 Feet Borehole Backfilled with Bentonite Holeplug		

WATER LEVEL OBSERVATIONS

While Drilling ▽ 17' Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/8/90 End 6/8/90
Driller ETI Chief KKT Rig D-5
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB39
Surface Elevation 644.9
Job No. 60251.12
Sheet 1 of 2

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
						Straight Drill to 8.5'		
						(0-5') FILL: Dark Gray Clayey and Silty Fine SAND, Traces of Debris such as paper, plastic, and rubber.		0
					5			
1		18	W	10		FILL: Black Silty Fine Sand (Stained with Solvent Odors)		40
					10	Becomes WASTE: Black, Brown and Dark Gray Waste in Sandy Matrix, Traces of Rubbery Glue-Like Material and Oily Saturated Sandy Fill		150
					15			
2		18	W	21		Estimate Fill to 16'		60
						Brown and Gray Silty Fine SAND, Trace Medium Sand, Trace of Thin Silt Layers (1/4") at 16.0-16.7'		
					20	Continue Drilling to 22'		
3		20	W	63		Grades to Brown and Gray Fine SAND, Trace to Some Silt, Trace to Some Gray Silt Layers at 23-23.3' (1/4-1/2" thick)		65
						Trace of Possible Discoloration in Sand above Silt Layers		
					25	Gray Silty Fine SAND with Silt Layers,		

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/11/90 End 6/11/90
Driller ETI Chief KKT Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB39
Surface Elevation 644.9
Job No. 60251.12
Sheet 2 of 2

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES	
No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)		qu (qa) (tsf)	PID (ppm)
						Grades into Gray Clayey Silt, Wet to Moist and Becoming Dense		
					30	End of Boring at 23.5 Feet Borehole Backfilled with Bentonite Holeplug		
					35			
					40			
					45			
					50			
					55			

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB40
Surface Elevation 644.2
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	SAMPLE Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
					0	FILL: Brown and Black Silty Fine to Coarse Sand, Traces of Plastic and Paper Material.		5
					5	Grades to Black Fill Material with Plastic, Wood, Metal Fragments and Refuse		40
1		14	W	10		At 8' Material Becomes Brown Fine to Medium Silty Sand, Black Stained Patches, Trace of Wood, Roots and Petroleum Sheen to 10'		120
					10	End of Boring at 10.0 Feet Borehole Backfilled with Bentonite Holeplug		
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/13/90 End 6/13/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB41
Surface Elevation 644.9
Job No. 60251.12
Sheet 1 of 2

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1		14	M	14	5	FILL: Black and Brown Sandy Matrix with Wood, Paper, Metal, Plastic		0
					10	Cuttings Range From Garbage Refuse in a Gray Sand Matrix		
2		12	W	56	15			
					20	Becomes Same FILL Refuse Material with Silty Sand Layers with Varying Amounts of Silty Clay Layers and Coarse Sand, Yellow Staining at 23.5'		2
					25	End of Boring at 23.5' Borehole Backfilled with		

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/13/90 End 6/13/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB41
Surface Elevation 644.9
Job No. 60251.12
Sheet 2 of 2

2100 CORPORATE DRIVE • ADDISON, ILLINOIS 60101 • TEL (708) 691-5000

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)		qu (qa) (tsf)	PID (ppm)			
						Bentonite Holeplug					
					30						
					35						
					40						
					45						
					50						
					55						

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB42
Surface Elevation 641.5
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						Clayey Material at Surface, Possible Cap		
1		12	M	100	5	FILL: Garbage Refuse Material Including Glass, Metal, Wood, Burn -----, Plastic in a Brown, Black, and Gray Sandy Clay Matrix		0.0
					10			
					15	Estimate Fill to 15'		
						Gray and Brown Fine to Medium Silty SAND, Trace Silty Clay Layers		
2		8	W	87	20			4.0
						End of Boring at 20.5 Feet Borehole Backfilled with Bentonite Holeplug		
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling ▼ _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/14/90 End 6/14/90
Driller ETI Chief TJC Rig D-5
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB43
Surface Elevation 650.2
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	Type	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)
1		10	M	6		FILL: Dark Brown Silty Fine Sand Fill with Traces of Solid Paint Pieces At 0.5' Grades to Brown and Dark Brown Silty Fine Sand Fill, No Odor		0
2		10	M	10		Becomes Brown Fine SAND, Trace Silt		0
					5	End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/14/90 End 6/14/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB44
Surface Elevation 649.1
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1		10	M	21		FILL: Dark Brown Silty Fine Sand At 0.7', Becomes Waste: Paint Solids in a Sandy Matrix at 1-2' below surface, Strong Solvent Odor, Paint Solids Include Yellow Purple, White, and Red Pigments, Dry/Moist with a Slight Rubbery Texture		
								80
2		10	M	121				
					5	Becomes Dark Gray Silty Fine Sand Fill, Traces of Dark Staining, (Some Oily) and Solid Paint-Like Pigments, Trace Fine Gravel. Strong Solvent Odor		145
						End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/14/90 End 6/14/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-3A
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monotox
						Crushed Stone and Sandy Surface					
						FILL: Dark Gray, Gray, and Brown Fine to Medium Sand. Trace of Silt and Clay. Several attempts to drive split spoon for soil samples. All unsuccessful due to obstructions and refusal. SB-3A and SB-3B are additional unsuccessful boring locations which were abandoned due to similar conditions of obstructive material near the surface. Field decisions were made to abandone the entire boring location for a test pit (TP-1). Relocate SB-3 to the Off-Site Containment Area.		3.0			
1		4	M/W	40				12.0			
					5						
					10	End Boring at 5'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 2.5 Upon Completion of Drilling
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/1/89 End 8/1/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
Phase I RI/FS
Location Griffith, Indiana

Boring No. SB-4
Surface Elevation
Job No. 60251.03
Sheet 1 of 1

2100 CORPRORATE DRIVE ADDISON, IL 60101 TEL(312) 691-5000

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth		qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Mor. to
						Vegetated Surface FILL: Black Silty Sand, Trace of Slag					
1		18	D	27		FILL: Brown and Black Silty Sand		2.0			
2		4	M	40	5	Spoon from 4-6' sample interval returns to surface covered with tar like substance. Open spoon to reveal poor recovery of brown sandy fill. Discover black liquid present inside hollow stem augers approximately 5' below ground surface. Innovate sampling device using a 4 oz jar taped to a tremmie pipe Collect sample of black liquid. Terminate boring.		8.0			
					10	End Boring at 6'					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/1/89 End 8/1/89
Driller ETI Chief KKT Rig D 50
Logger TJM Editor TWP
Drill Method 3 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB45
Surface Elevation 650.5
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	SAMPLE TYPE	SAMPLE Rec (in.)	SAMPLE Moist	SAMPLE N Value	SAMPLE Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	SOIL PROPERTIES PID (ppm)
1		10	M	22		FILL: Brown and Dark Brown (some Black staining) Silty Fine Sand, Trace Fine to Coarse Gravel, Slight Solvent Odor		
								125
2		18	M	7		Becomes FILL: Brown to Dark Brown Silty Fine Sand, Trace Fine to Coarse Gravel, Moist		
								120
					5	End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/14/90 End 6/14/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB46
Surface Elevation 648.2
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1	■	12	M	8		FILL: Brown Silty Fine SAND, Stained Various Colors (green, purple, and red) Drum Lids Encountered at 1-2'		1.0
2	■	10	M	79	5			<1.0
						End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▽
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/14/90 End 6/14/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB47
Surface Elevation 647.3
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1		8	M	5		FILL: Brown and Black Silty Fine Sand, Trace of Refuse Including Paper, Plastic and Color Staining (red and blue), Trace Fine to Medium Gravel, Dry with Slight Odor		
								5
2		5	M	35		Becomes Black Fill with Wood, Trace to Some Sandy Matrix, Paper and Glass, Slight Odor.		
					5			19
						End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/14/90 End 6/14/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB48
Surface Elevation 650.6
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE • ADDISON, ILLINOIS 60101 • TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1		10	M	10		FILL: Brown Silty Fine Sand with Trace to Some Paint-Like Staining (red, orange, green, blue and white), Slight Solvent Odors, Dry with Trace Grayish Staining		
								14
2		16	W	40		Becomes Brown Silty Fine Sand Fill with Fine to Coarse Gravel and Trace to Some Light Chocolate Colored Staining and Traces of Paint-Like Color Staining, Grades to Black (stained) Fine Sand at 4.3'		
					5			40
						End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/14/90 End 6/14/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB49
Surface Elevation 648.6
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES	
No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)		qu (qa) (tsf)	PID (ppm)
1		12	M	54		FILL: Black and Dark Brown Fine Sandy Sand and Gravel, Trace Coarse Limestone Gravel, Metal, Solid Paint Pigments and Black (stained) Fine Sand Wet in Coarse Sand and Gravel, Slight Odors		3.0
					5	End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/19/90 End 6/19/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB50
Surface Elevation 645.4
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1		8	M	7		FILL: Brown Silty Fine Sand, Trace of Black Stained Fine Sand, Fine Gravel, Roots, Paint Staining, and Perfume Odor		
								0.5
2		3	M	100		Becomes Dark Brown and Black Fine to Medium Sand and Fine Gravel Fill, Trace Coarse Gravel and Debris Like Glass, Wood, Plastic, Paper, and Aluminum Foil. Moist to Wet		
					5			20
						End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ MLT Upon Completion of Drilling ▼
Time After Drilling boring dry
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/19/90 End 6/19/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB52
Surface Elevation 644.8
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1		8	M	7		FILL: Brown Silty Fine Sand, Trace Fine to Medium Gravel, Some Light Green Paint-Like Staining at 0.7', Becomes Black Stained Fine Sand at 0.9', No Odors		1.0
2		5	W	18	5	FILL: Black Sand with Much Debris Like Plastic, Paper, Wood and Glass, Wet, Trace of Light Green Paint Like Substance and Olive-Green Stained Sand		
						End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/19/90 End 6/19/90
Driller FTI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB51
Surface Elevation 646.8
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	PID (ppm)
1		12	M	23	5	FILL: Black and Brown Silty Fine Sand with Debris Like Wood and Plastic, Becomes Brown Fine Sand with Various Colors of Paint-Like Staining with Heavy Solvent Odors, Traces of Black Oily Like Staining, Metal, Plastic Pellets, and Glass		200
						End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling ▼ _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/19/90 End 6/19/90
Driller ETI Chief TJC Rig D-5
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB53
Surface Elevation 645.0
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
1		10	M	24		FILL: Brown Silty Fine Sand, Becomes Black Silty Fine Sand, Some Fine to Coarse Gravel		
								1.0
2		14	M	8	5	Becomes Black Fine to Medium Sand and Fine Gravel, Trace to Little Silt, Trace Coarse Gravel and Limestone Cobbles		1.5
						End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/19/90 End 6/19/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB54
Surface Elevation 646.5
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIE qu (qa) (tsf)	PID (ppm)
						Straight Drill to 3'		
1		10	M	108		FILL: Black Silty Fine Sand, Trace to Some Debris Like Paper, Cloth and Plastic and Drum Lids		2.0
					5	End of Boring at 4.5 Feet Borehole Backfilled with Bentonite Holeplug		
					10			
					15			
					20			
					25			

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/19/90 End 6/19/90
Driller ETI Chief TJC Rig D-
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project American Chemical Services
RI/FS Phase II
Location Griffith, Indiana

Boring No. SB75
Surface Elevation 641.5
Job No. 60251.12
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL (708) 691-5000

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N Value	Depth (ft.)		qu (qa) (tsf)	PID (ppm)			
					0	Crushed Stone Road Gravel Surface Underlain by FILL: Dark Gray Fine Sand with Solvent Odors					
					5			70			
						Encountered Buried Objects Between 7 to 11'					
					10	Estimate Fill to 11'					
1		14	W	40		Brownish to Dark Gray Fine to Medium SAND, Trace to Little Fine to Coarse Gravel, Trace Silt		110			
					15	End of Boring at 15.0 Feet Borehole Backfilled with Bentonite Holeplug					
					20						
					25						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling ▼
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the transition may be gradual.

GENERAL NOTES

Start 6/28/90 End 6/28/90
Driller ETI Chief TJC Rig D-50
Logger TJM Editor SJB
Drill Method 4.25" ID HSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Off-Site Containment Area
Location: Griffith, Indiana

Boring No. SB77
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Vegetation, Brown Sand, Gravel and Clay, Black Discoloration			
1		3	M	4			FILL: Black Silty Sand, Pieces of Wood Chips (Organic Odor Present)		(--)	36
					5					
2		10	M	12			Grades into Brown Sandy Clay FILL at 6 Ft, Trace Silt		(--)	3
3		11	M	8			Organic Waste (Wood Chips) FILL: Brown Silty Fine Sand Grades to Black at 8.5 Ft		(--)	10
4		12	W	6			Organic Waste (Wood Chips 9-10')		(--)	11.5
					10		Grades into Loose Black Fine Silty Sand (SM) at 11 Ft			
5		20	W	9			Trace Clay, Black Fine Silty Sand (SM) Grades into Brown Silty Sand, Little Clay, Organic Debris		(--)	1
							End of Boring at 13 Feet			
					15		Backfill Borehole with Bentonite Chips and Cave-in			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 10.3 Upon Completion of Drilling ▼ 10.3
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/21/93 End 6/21/93 Drill
Driller E & F Chief DM Rig CME 750
Logger DAP Editor PMS
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Off-Site Containment Area
Location: Griffith, Indiana

Boring No. SB78
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Vegetation, Gray Silt, Sand, Clay and Some Gravel (Fill)			
1		4	M	2			FILL: Brown to Gray Silty Fine Sand, Pieces of Newspaper, Sponges, and Plastic		(--)	--
							FILL: Brown to Black Silty Fine Sand with Clay, Wood Chips Present			
2		6	M	11	5				(--)	--
3		4	W	21	▽		FILL: Gray, Black, Brown, Silty Sand, Pieces of Wood Chips		(--)	126
4		14	W	12	10		Gray to Black Silty Fine Sand (SM) Some Black Streaks in Gray Sand		(--)	402
							End of Boring at 12 Feet Borehole Backfilled with Granular Bentonite and Cave-in			
					15					

WATER LEVEL OBSERVATIONS

While Drilling ▽	8.0	Upon Completion of Drilling ▼	8.0	
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/21/93 End 6/21/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Off-Site Containment Area
Location: Griffith, Indiana

Boring No. SB79
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Vegetation - Clay, Sand, Gravel (Fill)			
1		4	M	23			Gray Brown & Yellow Sandy Clay (Fill) Some Scattered Wood Chips		(--)	1
2		8	M	15	5		Brown Sandy Silt, Grades into Gray Sandy Clay (Fill)		(--)	ND
3		18	M	10			Wood Chips and Orange Brown Leaves grades into Gray and Black Stained Clay, Then Grades into Gray Silty Clay (Fill) Slight Waste Odor.		(--)	2.8
							Wood Chips Present Throughout			
4		0	W	12 ▼					(--)	--
5		0	W	3	10				(--)	--
					15		End of Boring at 12 Feet Backfill Borehole with Bentonite Chips and Cave-in Material			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.8 Upon Completion of Drilling ▼ 8.8
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/21/93 End 6/21/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Off-Site Containment Area
Location: Griffith, Indiana

Boring No. SB80
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	Type	Rec. (in.)	Moisture	N Value	Depth (ft.)	Profile	VISUAL CLASSIFICATION and Remarks	Borehole Backfill	qu (qa) (tsf)	PID (ppm)
							Vegetation Gray and Brown Sandy Clay (Fill)			
1		14	M	9			Grades into Brown, Black and Gray Fine Sand, Scattered Wood Chips and Bricks		(--)	ND
2		16	M	8	5		Gray Brown Clayey Sandy Silty, Trace Fine to Coarse Gravel (Fill), Trace Wood Chips (Metal Strip in Shoe)		(--)	ND
3		10	W	15			Gray to Black Silty Sand (Fill), Wood Chips, Little Clay		(--)	1
4		12	W	7			Loose Gray Silty Fine Sand (SM)		(--)	ND
					10					
5		20	W	15			Gray Fine to Medium Sand, Some Coarse Sand (SP)		(--)	ND
					15		End of Boring at 14 Feet Backfill Borehole with Bentonite Chips and Cave-in Soils			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.0 Upon Completion of Drilling ▽ 8.0
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/21/93 End 6/21/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Off-Site Containment Area
Location: Griffith, Indiana

Boring No. SB81
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Vegetation then Gray Brown Fine Sand (SP) and Little Clay			
1		20	M	4			Grades into Loose Black Fine Sand (SP) Trace Clay at 3 Feet, Slight Organic Odor		(--)	13.7
2		18	M/W	8	5		Gray Brown Sand CLAY (CL) Coarse Grades into Brown Fine Sand at 5 Feet then into Black Fine Sand at 5.5 Feet Trace Clay		(--)	2.0
							Medium Dense Brown Fine Sand (SP), Trace Clay Grades into Gray Fine Sand at 8 Feet			
3		18	W	14					(--)	2.0
4		20	W	15	10		Medium Dense Gray Fine Sand (SP) Slight Solvent Odor		(--)	36
					15		End of Boring at 11 Feet Cave in to 4.5 Feet with Sand Backfill Borehole with Granular Bentonite and Cave-in from Soils			

WATER LEVEL OBSERVATIONS

While Drilling	▽ 4.5	Upon Completion of Drilling	▼ 4.0	
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Off-Site Containment Area
Location: Griffith, Indiana

Boring No. SB82
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Vegetation Then Gray Sandy Clay (CL)			
1		22	M	3			Brown and Gray Clay (CL) Little Silt, Some Black Staining and Roots Present		(--)	ND
2		22	M	3			Brown and Gray Clay (CL), Little Silt, Solvent-like Odor and Shine to Clay at 3.5 Feet		(--)	4
3		12	M/W	4	5		Grades into Gray Fine to Coarse Sand (SP) Trace Fine Gravel Solvent Odor and Sheen		(--)	1293
4			W	3			No Recovery		(--)	--
					10		End of Boring at 8 1/2 Feet Backfill with Granular Bentonite And Cave-in Soils			
					15					

WATER LEVEL OBSERVATIONS

While Drilling ▽ 5.9	Upon Completion of Drilling ▼ 5.9			
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Off-Site Containment Area
Location: Griffith, Indiana

Boring No. SB83
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Vegetation Followed by Dark Brown and Gray Clayey Sand (SC)			
1		20	M	32			Dense Light Brown Fine Sand (SP), Trace Medium Sand		(--)	ND
2		16	M	7	5		Some Rust Mottling		(--)	ND
							Grades into Orange Brown Clayey Fine to Coarse Sand, Little Fine Gravel (SC)			
					▼					
3		4	W	4			Dark Brown Fine to Medium Sand (SP) Grades into Gray (Solvent Odor) Trace Coarse Sand		(--)	63
4		4	W		10		Gray Fine to Coarse Sand (SP), Some Fine Gravel, Solvent Odor and Sheen Present		(--)	808
							End of Boring at 13 Feet Boring Backfilled with Granular Bentonite and Cave-in Soils			
					15					

WATER LEVEL OBSERVATIONS

While Drilling ▽ 7.2	Upon Completion of Drilling ▼ 7.2			
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME 750
Logger DAP Editor PMS
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Kapica-Pazmey Area
Location: Griffith, Indiana

Boring No. SB84
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Vegetation Followed by Gray, Brown and Black Clayey Sand (FILL) Debris Wood Chips, Paper, Plastic			
1		16	M	8	5		Medium Brown Fine Sand (SP) Little Medium to Coarse Sand, Trace Fine Gravel (Solvent Odor)		(--)	671
2		16	M	8			Medium Gray Brown Fine Sand (SP) Trace Medium to Coarse Sand, Some Black Streaks present Solvent Odor		(--)	195
3		16	M/W	9	10		Medium Brown Fine Sand (SP) Grades into Dark Gray Fine Sand, Black Streaks Scattered Throughout Sample		(--)	225
4		16	W	7			Grades into Gray to Black Fine to Coarse Sand at 12.5 Feet, Solvent Odor		(--)	--
					15		End of Boring at 13 Feet Backfill Borehole with Granular Bentonite and Cave-in Soils			

WATER LEVEL OBSERVATIONS

While Drilling ▽	3.0	Upon Completion of Drilling ▼	3.0	
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Kapica-Pazmey Area
Location: Griffith, Indiana

Boring No. SB85
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Vegetation Cover			
1		22	M	7			Loose Brown Fine Sand (SP)		(--)	0
2		22	M	7			Loose Brown Fine Sand (SP)		(--)	0
					5		End of Boring at 5 Feet Boring Backfilled with Granular Bentonite and Cuttings			
					10					
					15					

WATER LEVEL OBSERVATIONS

While Drilling ▽ ND	Upon Completion of Drilling ▼ ND			
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Kapica-Pazmey Area
Location: Griffith, Indiana

Boring No. SB86
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Sand Gravel and Metal Debris			
1		22	M	5			Orange Brown Fine Sand (SP), Trace Black Streaks, Very Slight Odor		(--)	845
2		22	M	3			Coarse Brown Fine Sand (SP), Trace Fine Gravel		(--)	195
					5		End of Boring at 5 Feet Boring Backfilled with Granular Bentonite and Cuttings			
					10					
					15					

WATER LEVEL OBSERVATIONS

While Drilling	▽ ND	Upon Completion of Drilling	▼ ND	
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services, Kapica-Pazmey Area
Location: Griffith, Indiana

Boring No. SB87
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Sand and Gravel Surface, Scattered Drum Lids (FILL)			
1		14	M	2	5		Orange-Brown Fine to Medium Sand (SP)		(--)	455
							Brown-Gray Clay (CL)			
							Light Brown Fine Sand (SP)			
2		14	M/W	4			Olive Gray Brown Sandy Clay (Solvent Odor)		(--)	698
3		16	M	11	10		Grades to Black Stained Fine SAND (SP), Trace Medium Sand, Solvent Odor From 8.5 to 9.5 Feet Dark Brown Fine to Medium SAND (SP), Trace Clay, Some Black Streaks and Solvent Odor Present		(--)	342
4		18	M/W	7	▽		Light Brown Fine SAND (SP), Solvent Odor Present		(--)	28
5		20	W	5					(--)	32
					15		End of Boring at 15 Feet Backfill Borehole with Granular Bentonite and Cave-in Soils			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 12.2 Upon Completion of Drilling ▼ 12.2
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME 750
Logger DAP Editor PMS
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Kapica-Pazmey Area
Location: Griffith, Indiana

Boring No. SB88
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	Type	Rec. (in.)	Moisture	N Value	Depth (ft.)	Profile	VISUAL CLASSIFICATION and Remarks	Borehole Backfill	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Refuse and Fill Material Consisting of Brown Sand and Clay			
					5					
1			M	10			Grades into Dark Brown to Brown Fine Sand (SP)		(--)	490
2			M	3	10		Brown Fine Sand (SP), Fine to Coarse, Solvent Odor		(--)	134
3			W	5			Brown Fine Sand, Some Medium to Coarse Sand (SP) Little Fine to Coarse Gravel, Solvent Odor		(--)	99
4			W	8			Gray Brown Fine Sand (SP), Little Medium to Coarse Sand, Trace Fine Gravel, Solvent Odor		(--)	36
					15		End of Boring at 14.5 Feet Borehole Backfilled With Bentonite Chips And Cave-in Soils			

WATER LEVEL OBSERVATIONS

While Drilling ▽	3.0	Upon Completion of Drilling ▼	3.0	
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
On-Site Containment Area
Location: Griffith, Indiana

Boring No. SB95
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	Type	Rec. (in.)	Moisture	N Value	Depth (ft.)	Profile	VISUAL CLASSIFICATION and Remarks	Borehole Backfill	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Sand and Gravel Surface			
1		22	M/W	9			Loose Gray Fine SAND (SP), Slight Solvent Odor		(--)	472
3		22	W	5			Loose Gray Brown to Gray Fine to Medium SAND (SP), Little Clay, Solvent-Like Odor, Some Black Staining of Sands		(--)	342
					5		End of Boring at 5 Feet Borehole Backfilled with Bentonite Chips and Soils from Surrounding Area			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 2.0	Upon Completion of Drilling ▼ 2.0			
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME 750
Logger DAP Editor PMS
Drill Method 2-1/4" ID HS A

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
On-Site Containment Area
Location: Griffith, Indiana

Boring No. SB96
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Gravel and Brown Sand Surface			
1		18	M	4			Loose Brown Fine SAND (SP), Trace Medium to Coarse Sand, Trace Gravel		(--)	ND
2		14	W	3			Loose Brown to Olive, Fine to Coarse SAND (SP), Little Clay, Solvent Odor (Olive Staining)		(--)	4
					5		End of Boring at 5 Feet Boring Backfilled with Bentonite Chips and Soil from Surrounding Area			

WATER LEVEL OBSERVATIONS

While Drilling	▽ 1.7	Upon Completion of Drilling	▼ 1.7	
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2-1/4" ID HS A

AUGER PROBE DESCRIPTIONS

Probe No.	Feet Below Ground Surface	Material Description	Maximum HNu (ppm)
NEAR KAPICA BUILDING			
AP-1	0 - 1.5	Gravel FILL	NR
	1.5 - 3.5	Dark Gray Sand (stained with odor)	20.0
	3.5 - 10	Brown Sand	15.0
AP-2	0 - 2	Gravel FILL	NR
	2 - 10	Dark Gray (stained) to Brown Sand	17.0
AP-3	0 - 2	Brown to Dark Gray silty Sand (stained with odor)	100.0
	2 - 4	Gray and Brown silty Clay (solvent odor)	50.0
	4 - 10	Dark Gray to Brown Sand	40.0
AP-4	0 - 7	Sandy FILL with Landfill Refuse	60.0
	7 - 10	Brown Sand	15.0
AP-5	0 - 6	Sandy FILL with Landfill Refuse (some drum lids)	70.0
	6 - 10	Brown Sand	NR
MOVING TOWARD OFF-SITE CONTAINMENT AREA			
AP-6	0 - 7	Sandy FILL with Landfill Refuse (oily sheen and paint-like odors detected)	3.0
	7 - 10	Dark Brown (stained) to Brown Sand	25
AP-7	0 - 3	Sandy FILL	10.0
	3 - 8.5	Black Sandy FILL with Landfill Refuse	2.0
	8.5 - 10	Brown Sand	4.0
AP-8	0 - 10	Brown to Gray Sand (with solvent odors)	70.0
AP-9	0 - 7	Sandy FILL with Landfill Refuse	40.0
	7 - 10	Brown and Gray Sand	12.0
OFF-SITE CONTAINMENT AREA			
AP-10	0 - 7	Sandy FILL with Landfill Refuse	4.0
	7 - 10	Dark Gray Sand (with solvent like odor)	80.0
AP-11	0 - 1	Sandy FILL	NR
	1 - 8	Sandy FILL with Trace of Landfill Refuse	50.0
	8 - 10	Brown Sand	70.0
AP-12	0 - 7	Sandy FILL	20.0
	7 - 10	Black tar-like waste (wire wound up on lead auger 9-10', stained)	70.0

Probe No.	Feet Below Ground Surface	Material Description	Maximum HNu (ppm)
AP-13	0 - 1	Sandy FILL	NR
	1 - 10	Black Sandy FILL with Landfill Refuse	1.0
AP-14	0 - 6	Sandy FILL with Trace of Landfill Refuse	15.0
	6 - 10	Dark Gray and Black Sand	90.0
AP-15	0 - 5	Sandy FILL	20.0
	5 - 6.5	Black Oily Waste	100.0
	6.5 - 10	Brown, Red and Black Sand (some staining)	65.0
AP-16	0 - 8	Brown to Dark Gray Sand FILL	60.0
	8 - 10	Sandy FILL with Landfill Refuse and a drum lid band	30.0
AP-17	0 - 7	Sandy FILL with Landfill Refuse	30.0
	7 - 10	Black to Gray Sand	3.0
AP-18	0 - 4	Sandy FILL with Landfill Refuse	5.0
	4 - 6	Dark Gray Sand	70.0
	6 - 10	Dark Gray Sand, (Trace of Landfill Refuse with oily staining)	80.0
AP-19	0 - 6	Sandy FILL	50.0
	6 - 8	Black Sand (stained with solvent odor)	80.0
	8 - 10	Brown Sand (with solvent odor)	120.0
AP-20	0 - 5	Sandy FILL with Trace of Landfill Refuse	50.0
	5 - 10	Drum lid at 5 ft then Brown Sand and Gravel (with solvent odors)	120.0
ON-SITE CONTAINMENT AREA			
AP-21	0 - 10	Brown to Dark Gray Sand	55
AP-22	0 - 0.5	Road Gravel	NR
	0.5 - 3.5	Brown Sand	5
	3.5 - 8	Dark Gray Sand (with petroleum-like odor)	200
	8 - 10	Gray Sand	200
AP-23	0 - 0.5	Road Gravel	NR
	0.5 - 3.0	Brown Sand	NR
	3.0 - 7.5	Gray Sand (black staining at 6-ft, with petroleum-like odor)	20
	7.5 - 10	Black to Gray Sand	5

AUGER PROBE DESCRIPTIONS

Probe No.	Feet Below Ground Surface	Material Description	Maximum HNu (ppm)
AP-24	0 - 0.5	Road Gravel	NR
	0.5 - 10	Brown to Gray Sand	230
AP-25	0 - 0.5	Road Gravel	NR
	0.5 - 3.5	Brown and Gray Sand	100
	3.5 - 10	Gray Sand	200
AP-26	0 - 0.5	Road Gravel	NR
	0.5 - 6.5	Brown Sand (napthalene-like odor)	190
	6.5 - 10	Gray Sand	130
AP-27	0 - 0.5	Road Gravel	NR
	0.5 - 3.5	Brown Sand (napthalene-like odor)	150
	3.5 - 5.5	Brown to Gray Sand	50
	5.5 - 10	Dark Gray and Black Sand	14
AP-28	0 - 5.0	Brown Sand	200
	5.0 - 10	Gray Sand (possible staining at 9 to 10 ft)	160
AP-29	0 - 5.0	Brown to Gray Sand	50
	5.0 - 10	Gray to Dark Gray Sand	80
AP-30	0 - 2.5	Brown Sand	7
	2.5 - 10	Brown to Gray and Black Sand	9
AP-31	0 - 10	Brown to Gray Sand	9
AP-32	0 - 5.5	Brown Sand	10
	5.5 - 10	Black to Gray Sand	20
AP-33	0 - 2 (est)	Brown Sandy FILL (with many drum carcasses and/or lids)	NR
	2 - 7	Brown to Gray Sand	250
	7 - 10	Black to Gray Sand	270
AP-34	0 - 4	Brown Sand	190
	4 - 8	Gray Sand	15
	8 - 10	Dark Gray Sand	150
AP-35	0 - 4	Brown Sand	18
	4 - 7.5	Black Sand	5
	7.5 - 10	Gray Sand	9
TREATMENT LAGOON AREA			
AP-36	0 - 7	Brown Sand and Gravel (with solvent odors)	40
	7 - 10	Black Sand	40

Probe No.	Feet Below Ground Surface	Material Description	Maximum HNu (ppm)
AP-37	0 - 2.5	Brown Sand and Gravel	NR
	2.5 - 7.5	Black Silt (Traces of liquid waste)	35
	7.5 - 10	Brown Liquid Wastes (Trace of drum parts)	85
AP-38	0 - 4	Brown Sand and Gravel (some black waste at 2.5 ft)	NR
	4 - 8	Brown and Red Sand and Gravel (with oily staining and solvent odors)	90
	8 - 10	Black Sand	85
AP-39	0 - 10	Brown Sand and Gravel (with strong odor)	90
STILL BOTTOMS AREA			
AP-40	0 - 7	Brown Sand	NR
	7 - 10	Gray Sand (with oily sheen, solvent odors)	35
AP-41	0 - 4	Gray to Brown Sand	NR
	4 - 10	Gray Sand and Gravel	0
TREATMENT LAGOON AREA			
AP-42	0 - 4	Dark Gray Sand	50
	4 - 5	Red Sand	40
	5 - 10	Gray Sand	95
AP-43	0 - 3.5	Brown Sand	NR
	3.5 - 7.5	Brown and Gray Sand (with solvent odors)	95
	7.5 - 10	Reddish Sand and Gravel (some oily waste)	95
AP-44	0 - 2	Brown Sand	NR
	2 - 4	Black Sand	NR
	4 - 10	Gray Sand (with solvent odor)	65
AREA WEST OF FIRE POND			
AP-45	0 to 3	Sandy FILL with Rubble	NM
	3 to 6.5	Black Silty Fine SAND, Odorous	10
	6.5 to 10	Gray Silty Fine SAND, Odorous	10
AP-46	0 to 7	Black and Dark Gray Silty Fine Sand FILL, odorous	100
	7 to 8	Black Organic PEAT	NM
	8 to 10	Gray Silty Fine SAND, Trace Clay	25
AP-47	0 to 6.5	Black and Dark Gray Silty Fine Sand FILL, Trace Gravel, odorous	220
	6.5 to 7.5	Silty Fine SAND, Trace Peat, Trace oily substance	150
	7.5 to 10	Dark Gray to Gray Silty Fine SAND	80

AUGER PROBE DESCRIPTIONS

Probe No.	Feet Below Ground Surface	Material Description	Maximum HNu (ppm)
AP-48	0 to 4	Black, Gray, and Brown Silty Fine Sand FILL	5
	4 to 6	Dark Gray Silty Fine SAND	15
	6 to 7	Black Peat-like Silty Fine SAND, Trace Clay	15
	7 to 8	Dark Gray Silty Fine SAND	5
	8 to 10	Gray Fine SAND	5
AP-49	0 to 5.5	Brown to Dark Brown Silty Fine SAND	15
	5.5 to 7	Gray to Dark Gray Silty Fine SAND	8
	7 to 7.5	Black PEAT, Trace Silty Fine Sand	NM
	7.5 to 10	Brown and Gray Fine SAND	10
AP-50	0 to 3.5	Brown Fine Sand FILL, Trace Gravel	10
	3.5 to 6.5	Brown and Gray Silty Fine SAND	100
	6.5 to 10	Brown Fine to Medium SAND, Trace Gravel, Black staining at 8 feet	50
AP-51	0 to 7	Black Silty Fine SAND, Odorous	230
	7 to 10	Gray Fine SAND	150
AP-52	0 to 2.5	Brown Fine to Medium Sand FILL	NM
	2.5 to 7	Black Silty Fine SAND, Trace Gravel	200
	7 to 10	Gray Fine to Medium SAND	20
AP-53	0 to 2	Brown Fine Sand FILL	NM
	2 to 4	Black Silty Fine SAND	200
	4 to 6	Dark Gray Fine SAND, Trace Gravel	200
	6 to 8	Black Silty Fine SAND, Trace organics	100
	8 to 10	Gray Fine SAND	20
OFF-SITE CONTAINMENT AREA			
AP-54	0 to 4	Coarse Limestone Gravel FILL	0
	4 to 10	Brown and Gray Fine SAND	8
AP-55	0 to 3.5	Coarse Gravel and Black Sand FILL	5
	3.5 to 6	Black to Dark Brown Fine Sand FILL, Trace Gravel	22
	6 to 10	Brown Fine SAND	8
AP-56	0 to 3.5	Black Fine Sand FILL, Trace debris and gravel	15
	3.5 to 6	Dark Gray Fine Sand FILL	5
	6 to 10	Gray and Black Fine to Medium Sand FILL, Trace debris and refuse	18
AP-57	0 to 10	FILL: Black Fine to Medium Sand, Trace debris and refuse	1
AP-58	0 to 7	Black and Brown Fine Sand FILL, Trace to some debris and refuse	NM
	7 to 10	FILL: Sand with paint-like staining (red, orange and purple pigments). Heavy solvent odors, Traces of debris and refuse	150

Probe No.	Feet Below Ground Surface	Material Description	Maximum HNu (ppm)
AP-59	0 to 5	Black and Dark Gray Sand FILL, Trace debris and refuse	20
	5 to 10	Waste consisting of a sludge-like/paint-like substance with various paint-like staining of white, orange, gray blue, and purple	150
AP-60	0 to 5	Black and Dark Gray Sand FILL, Trace gravel and debris	40
	5 to 6.5	Black and Dark Gray Sand FILL, Trace of solid paint-like pigments	NM
	6.5 to 10	Brown Fine SAND	180
AP-61	0 to 7	Black Sand FILL, Trace debris	40
	7 to 10	Brown Fine SAND	110
AP-62	0 to 3	Black and Brown Sand FILL	80
	3 to 6.5	Black Sand FILL, Trace gravel and debris	35
	6.5 to 10	Brown Fine SAND	80
AP-63	0 to 10	Dark Gray and Dark Brown Sand FILL, Trace rubble and debris	0
	10 to 13.5	Dark Brown and Dark Gray Fine SAND	0
AP-64	0 to 1	Brown Fine to Medium Sand FILL	NM
	1 to 11	Black Silty Sand FILL, Trace debris	1.0
	11 to 13.5	Black to Dark Gray Silty Fine SAND	0
AP-65	0 to 11.5	Brown to Black Silty Fine Sand FILL, Trace rubble and gravel Paint-like odors at 7 feet	5.0
	11.5 to 13.5	Brown to Gray Fine SAND	< 1.0
AP-66	0 to 2	Brown to Black Silty Fine Sand FILL, Trace rubble	0.5
	2 to 12	Black Silty Fine Sand FILL, Trace debris	1.7
	12 to 13.5	Black and Brown Refuse FILL	0
AP-67	0 to 3	Brown to Black Silty Fine Sand FILL, Trace Gravel	40
	3 to 13.5	Black Refuse and Silty Fine Sand FILL	15
AP-68	0 to 13.5	Brown to Black Silty Fine Sand FILL, Trace debris, Oily sheen and staining at 10 feet	50
AP-69	0 to 3	Brown Silty Fine Sand FILL	40
	3 to 12	Dark Gray Silty Fine Sand FILL, Trace Clay, Sand, Gravel and Debris	170
	12 to 13.5	Brown Fine SAND, Trace staining	100
AP-70	0 to 13.5	Dark Brown and Black Silty Fine Sand FILL with Refuse and Debris	3.0

AUGER PROBE DESCRIPTIONS

Probe No.	Feet Below Ground Surface	Material Description	Maximum HNu (ppm)
AP-71	0 to 1	Brown and Black Silty Fine Sand FILL	NM
	1 to 12	Black Silty Fine Sand FILL with debris	1.0
	12 to 13.5	Black to Dark Gray Fine SAND	0
OFF-SITE CONTAINMENT AREA, SURFICIAL OILY-WASTE AREA			
AP-72	0 to 1	Black Silty Fine Sand FILL	NM
	1 to 5	Encountered buried object covered or full of black oily liquid. Did not bring to surface.	70
AP-73	0 to 2.7	Dark Brown and Black Silty Fine Sand FILL, some debris and refuse	70
	2.7 to 5	Black Silty Fine Sand FILL saturated with black oily liquid	120
AP-74	0 to 4	Dark Brown to Black Silty Fine Sand FILL	60
	4 to 7	Black Silty Fine Sand FILL saturated with black oily liquid	100
	7 to 10	Dark Brown Silty Fine Sand FILL, Trace refuse	140
AP-75	0 to 10	Dark Brown to Black Silty Fine Sand FILL, Little black oil staining and Trace debris at 4.5 to 7.5 feet	120
AP-76	0 to 6.5	Brown Silty Fine Sand FILL, Trace debris	75
	6.5 to 10	Brown Silty Fine SAND, Trace black staining	100
AP-77	0 to 4	Dark Brown to Black Silty Fine Sand FILL, Trace debris	100
	4 to 7	Black Silty Fine Sand FILL saturated with black oily liquid	100
	7 to 9	Grayish purple (stained) and Dark Brown Silty Fine SAND, Trace Gravel	125
	9 to 10	Dark Brown and Black Silty Fine SAND	NM
KAPICA AREA			
AP-78	0 to 7	Dark Gray and Black Silty Fine Sand FILL, Trace staining and debris	50
	7 to 10	Black to Brown Silty Fine SAND	10
AP-79	0 to 6.5	Brown and Dark Gray Silty Fine Sand FILL	40
	6.5 to 10	Brown Fine SAND	5
AP-80	0 to 1	Brown Fine Sand FILL, Trace solid paint-like pigments	NM
	1 to 10	Brown Fine SAND, Trace black staining at 7 to 9.5 feet	110
AP-81	0 to 1.5	Coarse Limestone Gravel and Sand FILL	1.0
	1.5 to 5.0	Buried objects (possible drum lids). Did not bring to surface	2.0

Probe No.	Feet Below Ground Surface	Maximum Material Description	HNu (ppm)
AP-82	0 to 5	Dark Brown Silty Fine Sand FILL, Trace debris	1.5
	5 to 10	Dark Brown and Black Silty Fine Sand FILL, Strong odors. Traces of black staining	55
AP-83	0 to 2	Brown Sand FILL with Coarse Gravel on surface	4.0
	2 to 3.5	Buried objects (possible drum lids)	
	3.5 to 10	Brown and Dark Gray Fine Sand FILL, Trace gravel and staining	25

Notes:
Material description and observations based on drill cuttings. Split-spoon soil sampling was not conducted during auger probes.
ppm = parts per million (of Benzene equivalent)
NM = Not Measured.

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Kapica-Pazmey Area
Location: Griffith, Indiana

Boring No. SB88A
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Vegetation Followed by Sand, Clay, Gravel, and Garbage (Paper and Plastic) Logged by Cuttings			
1			M	6	5		No Recovery Stone Stuck in Shoe. Cuttings: Dark Brown Fine Sand		(--)	--
2			M	4			No Recovery		(--)	--
					10		End of Boring at 9 Feet Backfill Borehole with Bentonite Chips and Cave-in Soils			
					15					

WATER LEVEL OBSERVATIONS

While Drilling ▽ 3.0		Upon Completion of Drilling ▼ 3.0		
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/23/93 End 6/23/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Still Bottoms/Treatment Lagoon
Location: Griffith, Indiana

Boring No. SB89
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	Type	Rec. (in.)	Moisture	N Value	Depth (ft.)	Profile	VISUAL CLASSIFICATION and Remarks	Borehole Backfill	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Sand and Gravel Fill			
							Black Stained Fine Sand (SP), Trace Medium to Coarse Sand, Trace Fine Gravel, Roots Present, Solvent Odor			
1			M	7					(--)	28
2			W	7			Loose Dark Brown Stained Fine Sand (SP), Roots Present, Trace Medium to Coarse Sand, Trace Fine Gravel, Solvent Odor		(--)	111
					5					
3			W	9			Loose Gray Fine Sand (SP), Trace Medium to Coarse Sand, Solvent Odor		(--)	72
4			W	10			Grades into Gray Fine to Coarse Sand, (SP), Trace Fine to Coarse Gravel		(--)	57
					10		End of Boring at 10 Feet Backfill Borehole with Bentonite Chips and Soil from Area			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 3.3	Upon Completion of Drilling ▼ 3.3			
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/23/93 End 6/23/93 Drill
Driller E & F Chief DM Rig CME 750
Logger DAP Editor PMS
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Still Bottoms/Treatment Lagoon
Location: Griffith, Indiana

Boring No. SB90
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE	BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Sand and Gravel Fill				
1		20	M	5			Loose Dark Brown Fine Sand (SP) Solvent Odor, Tar-Like Feel to Sample			(--)	721
2		20	M	10			Medium Dense Dark Brown Fine Sand (SP) Tar-Like Substance Making Sample Sticky, Solvent Odor			(--)	40
					5						
3		20	W	11	▼		Medium Dense Olive Brown Gray Fine Sand (SP) Solvent Odor, Black Tar-Like Staining			(--)	3
4		16	W	11						(--)	3
					10		End of Boring at 10 Feet Backfill Borehole with Soil From Area				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0	Upon Completion of Drilling	▼ 6.0		
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME 750
Logger DAP Editor PMS
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Still Bottoms/Treatment Lagoon
Location: Griffith, Indiana

Boring No. SB91
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	Type	Rec. (in.)	Moisture	N Value	Depth (ft.)	Profile	VISUAL CLASSIFICATION and Remarks	Borehole Backfill	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Sand and Gravel (FILL)			
1		18	M	5			Loose Dark Brown Fine Sand (SP) Trace to Little Medium to Coarse Sand and fine Gravel, Solvent Odor, Little Black Staining		(--)	599
2		18	M	4					(--)	284
					5		Grades into Loose Black Fine Sand (SP) at 4.0 Feet, Little Silt and Clay, Roots Present, Solvent Odor			
3		22	W	8			Loose Dark Brown Fine Sand (SP) Trace Medium to Coarse Sand, Trace fine Gravel, Solvent Odor		(--)	59
4		20	W	11					(--)	22
					10		End of Boring at 10 Feet Backfill Borehole with Soil From Area			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0 Upon Completion of Drilling ▼ 6.0
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/22/93 End 6/22/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Still Bottoms/Treatment Lagoon
Location: Griffith, Indiana

Boring No. SB92
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BACKFILL BOREHOLE	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Gravel Surface			
1		22	M	6			Loose Black Stained Fine Sand (SP) Little Silt and Clay, Roots Present in 1 - 2 Foot Section, Solvent Odor		(--)	19
2		22	M	5			Loose Black Stained Fine Sand (SP) Little Silt and Clay, Roots Present, Solvent Odor, Tar-Like Consistency to Soils		(--)	455
					5					
3		19	W	10			Medium Dense Dark Brown Stained Fine Sand (SP), Trace Silt, Solvent Odor		(--)	321
4		20	W	25			Black Oily Sand with Tar-Like Substance from 8' to 9'		(--)	479
							Gray Fine Sand (SP), Sand Black Staining and Streaks			
					10		End of Boring at 10 Feet Backfill with Surrounding Soils			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0	Upon Completion of Drilling ▼ 6.0			
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/23/93 End 6/23/93 Drill
Driller E & F Chief DM Rig CME
Logger DAP Editor PMS 750
Drill Method 2 1/4" IDHSA

WARZYN

LOG OF TEST BORING

Project: American Chemical Services
Still Bottoms/Treatment Lagoon
Location: Griffith, Indiana

Boring No. SB93
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 CORPORATE DRIVE - ADDISON, ILLINOIS 60101 - TEL. (708) 691-5000

SAMPLE Number	TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	PROFILE	VISUAL CLASSIFICATION and Remarks	BOREHOLE BACKFILL	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
							Sand and Gravel			
1		20	M	5			Orange Brown Fine SAND (SP), Strong Solvent Odor		(--)	1007
2		18	W	7			Loose Orange Brown Fine SAND Grading to Light Brown Fine SAND (SP) at 4 Feet		(--)	1214
					5					
3		20	W	9			Loose Orange Brown Fine SAND (SP), Solvent Odor, Little Gray and Black Streaks Present		(--)	384
							End of Boring at 8 Feet Boring Backfilled with Granular Bentonite and Soil from Surrounding Areas			
					10					

WATER LEVEL OBSERVATIONS

While Drilling	▽ 3.0	Upon Completion of Drilling	▼ 3.0	
Time After Drilling				
Depth to Water				
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

GENERAL NOTES

Begin 6/23/93 End 6/23/93 Drill
Driller E & F Chief DM Rig CME 750
Logger DAP Editor PMS
Drill Method 2 1/4" IDHSA

MONTGOMERY WATSON

LOG OF TEST BORING

Project: American Chemical Services
Still Bottoms/Treatment Lagoon
Location: Griffith, Indiana

Boring No. SB94
Surface Elevation
Job No. 20007001
Sheet 1 of 1

2100 Corporate Drive, Addison, Illinois 60101, TEL. (708) 691-5000

SAMPLE No.	SAMPLE TYPE	Rec. (in.)	Moisture	N Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	PID (ppm)
						Sand and Gravel Surface		
		10		11		Black Fine Sand and Gravel (SP) to 2 Feet Orange Brown Fine to Coarse Sand (SP)	(--)	
		20		7	▼	Loose Orange Brown Fine to Coarse Sand (SP), Some Fine to Coarse Gravel, Oily Varnish Substance Present, Solvent Odor	(--)	
					5			
		16		4		Orange Brown - Varnish Stained Fine to Coarse Sand Little Fine to Coarse Gravel, Strong Odor	(--)	
						End of Boring at 8 Feet Boring Backfilled with Granular Bentonite and Soil From Surrounding Area		
					10			
					15			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 3.0 ft. Upon Completion of Drilling ▼ 3.0 ft.
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Begin 6/23/93 End 6/23/93
Driller E & F Chief DM Rig CME 750
Logger DAP Editor PMS
Drill Method 2 1/4" IDHSA

ID: JKP

WARZYN

Project: ACS
Kapica Area
Location: Griffith, Indiana

Pit No. TP-1
Surface Elevation 650
Job No. 60251.03
Date 8/15/89

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Sample No.	Ground Water Level ▽	Moisture	Depth	VISUAL CLASSIFICATION AND REMARKS
				1115 Begin excavation of Test Pit TP-1
				(0 to 2.0 ft.) Fill: Brown, dark gray, and black silty sand, trace to some drum lids and metallic debris. Trace of color paint-like pigments in silty sand.
			2.5	
1		M	3.5	
	4.0	W		(2.0 to 5.0 ft.) Fill: Increased amount of drum carcasses and lids. Mostly corroded and mangled. Dark brown silty sand matrix with some paint-like pigments.
			5	
2		W	6.0	
—	—		End of Pit 7.5	
			10	1125 Collect sample of waste material in and around drum carcasses approximately 3.5 feet below ground surface. Sample: ACS-TP-1-3.5' HNU headspace = 150 ppm. Fill and drum carcasses to approximately 5.5 feet below ground surface. Native soils encountered at 5.5-6.0 feet. Brown fine sand, trace of black staining.
			12.5	
			15	
			17.5	1135 Collect sample of native soil beneath waste material. Sample: ACS-TP-1-6.0' HNU headspace = 11.0. Backfill pit with removed material.
			20	1200 End of excavation at 6.5 ft.

WATER LEVEL OBSERVATIONS

While Excavating: 4.0 ft.
Upon Completion of Excavating: 4.0 ft.
Time After Excavating:
Depth to Water:
Depth to Cave In:

GENERAL NOTES

Equipment Used: Dynahoe 190 rubber tire backhoe 1 yd^3 bucket
Geologist: Tim Maley
SSO: Leon Matejka

WARZYN

LOG OF SOIL TEST PIT

Project: ACS
On site containment area
Location: Griffith, Indiana

Pit No. TP-2
Surface Elevation 639
Job No. 60251.03
Date 8/15/89

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Sample No.	Ground Water Level ▽	Moisture	Depth
1		M	2.5
	4.0	W	
2		W	5
			End of Pit
			7.5
			10
			12.5
			15
			17.5
			20

VISUAL CLASSIFICATION AND REMARKS

1500 Begin excavation of test pit - TP-2

(0 to 1.0 ft.) Dark brown silty/sandy fill.

(1.0 to 5.0 ft.) Begin to encounter buried drums between 1.0 to 2.0 feet below ground surface. As drums are moved and/or carried out of pit, observe various liquids such as: brownish water/oil substance, thin medium blue liquid, and two drums containing a heavier blue paint-like liquid. Drums appear corroded, mangled, and mostly carcasses. Drums lying on their sides, packed closely together, directly next to one another. Estimate 3 to 4 drum thickness layer.

1510 Collect sample of waste material near drums at approximately 3 feet depth; material looks like blueish paint-like sludges, various colored staining, and sandy matrix.
Sample: ACS-TP-2-3' HNU headspace = 190 ppm
Native soil encountered at 5 ft.
Brown (unstained) fine to coarse sand.
Trace fine gravel.

1520 Collect sample of native soil.
Sample: ACS-TP-2-5' HNU headspace = 160 ppm.

End of excavation at 5½ ft. Backfill pit with removed material.

WATER LEVEL OBSERVATIONS

While Excavating 4.0
Upon Completion of Excavating 4.0
Time After Excavating
Depth to Water
Depth to Cave In

GENERAL NOTES

Equipment Used: Dynahoe 190 rubber tire backhoe
1 yd³ bucket
Geologist: Tim Maley
SSO: Leon Matejka

WARZYN

LOG OF SOIL TEST PIT

Project: ACS Treatment Pond No. 1 area
Location: Griffith, Indiana

Pit No. TP-3
Surface Elevation 642
Job No. 60251.03
Date 8/16/89

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Ground Water Level	Sample No.	Moisture	Depth	VISUAL CLASSIFICATION AND REMARKS
				Road Gravel Surface
				1000 Begin excavation of Test Pit TP-3
				(0 to 1.0 ft.) Fill: Brown silty sand and gravel. HNU = 0 ppm
			2.5	(1.0 to 7.0) Fill: Brown and black silty sand, traces of staining. Drum lid band recovered from 5 ft. Roots detected at 7 ft. Black staining at 7½ to 8 ft. HNU = 30 ppm at 8 ft.
			5	
			7.5	(7.0 to 9.0 ft.) Black stained silty sandy fill. Buried drum encountered at 9.0 ft. Brown and purplish viscous liquid accumulates in base of pit. HNU = 50 ppm in the pit at that time.
	1	M	9.0	
			10	1050 Collect waste sample of stained and oily saturated sandy fill; 9 feet depth. Sample: ACS-TP-3-9' (plus duplicate) HNU headspace = 60 ppm
				End of Pit
			12.5	Attempt to excavate deeper for a native soil sample but walls of pit continually slough into pit. Decide to abandon native soil sample attempt for a soil boring. (SB-14) Strong odors eminating from removed fill material. End of excavation at 10½ ft. Backfill pit with removed material.
			15	
			17.5	
			20	

WATER LEVEL OBSERVATIONS

While Excavating: None
Upon Completion of Excavating: None
Time After Excavating:
Depth to Water:
Depth to Cave In:

GENERAL NOTES

Equipment Used: Dynahoe 190 rubber tire backhoe with 1 yd³ bucket
Geologist: Tim Maley
SSO: Leon Matejka

LOG OF SOIL TEST PIT

NARZYN

Project: ACS
Treatment pond No. 1 Area
Location: Griffith, Indiana

Pit No. TP-4
Surface Elevation 641
Job No. 60251.03
Date 8/16/89

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ound Water Level	Moisture		
ıple o.			Depth
			2.5
			5
			7.5
	M		End of Pit
			10
			12.5
			15
			17.5
			20

VISUAL CLASSIFICATION AND REMARKS

Road Gravel Surface

1400 Begin excavation of Test Pit TP-4

(0 - 7 ft.) Fill: Brown fine sand; HNU =1.0 ppm
Dark gray and black staining at 3 - 4 ft.
HNU readings at 6 ft. = 10 ppm
Drum lid encountered at 7.0 ft.

(7.0 to 8.0) Brown and black (stained) sandy fill saturated with a thin oil-like brownish liquid. Liquid continually accumulates in base of pit.

1440 Collect sample of waste material of stained and saturated sandy fill at 8 ft. depth.
Sample: ACS-TP-4-8' HNU headspace = 200 ppm.

End of test pit at 8 ft.
Backfill pit with removed material.
Location considered for at soil boring for native soil sample. (SB-15)

WATER LEVEL OBSERVATIONS

While Excavating: None
Upon Completion of Excavating: None
Time After Excavating:
Depth to Water:
Depth to Cave In:

GENERAL NOTES

Equipment Used: Dynahoe rubber tire backhoe 1 yd³ bucket
Geologist: Tim Maley
SSO: Leon Matejka

WARZYN

Project: ACS
Treatment Pond No. 1 Area
Location: Griffith, Indiana

Pit No. TP-5
Surface Elevation 642
Job No. 60251.03
Date 8/17/89

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Sample No.	Ground Water Level ▽	Moisture	Depth
1		M	2.5–3.0 * End of Pit

VISUAL CLASSIFICATION AND REMARKS

Road Gravel Surface

0910 Begin excavation of Test Pit TP-5

(0 - 2.0 ft) Fill: Brown and black silty sand

(2.0 - 3½ ft.) Mangled drum encountered at 2.0 ft. Contains black oily liquid (appears mostly water) with some black sludge. Much of the liquid loose and situated in sandy fill around the drum(s). Another drum observed in pit at about 2½ - 3 ft. depth.

0920 Collect waste sample of black liquid substance mixed with some sludge and sand.
Sample: ACS-TP-5-3'. HNU headspace = 160 ppm.

End of Test Pit at 3 ft.
Backfill pit with removed material.

Location considered for a soil boring to sample native under-soil. (SB-16)

WATER LEVEL OBSERVATIONS

While Excavating: None
Upon Completion of Excavating: None
Time After Excavating:
Depth to Water:
Depth to Cave In:

GENERAL NOTES

Equipment Used: Dynahoe — rubber tire backhoe — 1 yd³ bucket
Geologist: Tim Maley
SSO: Leon Matejka

LOG OF SOIL TEST PIT

WARZYN

Project: ACS
Still Bottom Pond Area
Location: Griffith, Indiana

Pit No. TP-6
Surface Elevation 641
Job No. 60251.03
Date 8/17/89

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Ground Water Level	Sample No.	Moisture	Depth	VISUAL CLASSIFICATION AND REMARKS
				Road Gravel Surface
				1110 Begin excavating Test Pit TP-6.
				(0 - 3 ft.) Fill: Brown-gray silty sand. Grades into dark brown at 3 ft.
				(4 - 8 ft.) Fill: Dark gray silty sand (stained) at 4.0 ft. Grades back into dark brown silty sand. Trace of roots at 8 ft. Blue paint-like viscous substance runs out of apparent drum buried in wall of pit at 3½ ft. HNU readings = 130 ppm in pit.
			2.5	
		D/M		
			5	
			7.5	Stratigraphy in wall of pit shows various layering of discoloration between 2 - 5 ft. Traces of paint-like colors and oily staining. Native soil below encountered drum.
			End of Pit	(5 - 8 ft.) Brown fine sand.
			10	1140 Collect waste sample of blue paint-like substance along with stained sandy surrounding matrix. (ACS-TP-6-4')
			12.5	Attempt to clean out pit of sloughed waste. Unable to collect adequate native under-soil sample. Walls collapse. End of test pit at 8 ft. Backfill pit with removed material. Location considered for soil boring to sample native under-soil. (SB-17)
			15	
			17.5	
			20	

WATER LEVEL OBSERVATIONS

While Excavating: None
Upon Completion of Excavating: None
Time After Excavating:
Depth to Water:
Depth to Cave In:

GENERAL NOTES

Equipment Used: Dynahoe rubber tire backhoe 1 yd³ bucket
Geologist: Tim Maley
SSO: Leon Matejka

WARZYN

LOG OF SOIL TEST PIT

Project: ACS
Still Bottom Pond Area
Location: Griffith, Indiana

Pit No. TP-7
Surface Elevation 641
Job No. 60251.03
Date 8/17/89

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Sample No.	Ground Water Level	Moisture	Depth	VISUAL CLASSIFICATION AND REMARKS
				Road Gravel Surface
				1410 Begin excavating Test Pit TP-7. Brown gravel sand 0 - 1'. Fill.
			2.5	Brown-gray silty sand fill 90 ppm.
				Encounter drum at 3'. Bring to surface and discover it contains jelly-like brown opaque substance. Surrounding sandy fill saturated with black and rusty brown staining.
			5	Collect waste sample from surrounding sandy fill and substance in drum.
				Sample: ACS-TP-7-3' HNU == 90 ppm (Jelly-like substance difficult to dissect.)
			7.5	End of test pit at 3½ ft.
				Backfill test pit with removed material.
			10	Location considered for a soil boring with sampling for native under soil. (SB-18)
			12.5	
			15	
			17.5	
			20	

WATER LEVEL OBSERVATIONS

While Excavating: N/A
Upon Completion of Excavating: N/A
Time After Excavating:
Depth to Water:
Depth to Cave In:

GENERAL NOTES

Equipment Used: Dynahoe rubber tire backhoe
1 yd² bucket
Geologist: Tim Maley
SSO: Leon Matejka

B

DRILLING AND SOIL SAMPLING SOP

Section: Subsurface Exploration and Sampling	Section Number 103	Date of Issue April 1993	Reviewed By G. Prior
Subject: Hollow Stem Augering	Page of 1 15	Date Revised \	~~Authorized~~ By

Scope and Application: This method is applicable to drilling unconsolidated or loosely consolidated formations for well installation and soil sampling up to 70 ft deep; and for drilling garbage for well installation.

Method: Appropriately sized hollow stem augers.

Reference: ASTM D1586-84, ASTM D158-83, Unified Soil Classification System
For Wisconsin: - Chapter NR 141 Wisconsin Administrative Code.

I. PRE-FIELD CHECKLIST

A. Health and safety plan with related instruments

B. Underground utility check: 5 to 7 day advance notice

C. Off-Site access agreements completed

D. Sampling plan detailing sample types, sample intervals and sampling objectives

E. Field boring log forms: Warzyn Standard or Client Specific (i.e. Waste Management Inc. or BFI form if drilling for them)

F. Daily Drilling Summary (see Drilling RFQ Preparation SOP)

G. Unified Soil Classification System Summary (see Boring Log Preparation SOP)

H. Warzyn's general notes on Log of Test Boring

I. Munsell soil color chart (generally optional - required for Wisconsin solid waste projects)

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J. Decon solutions, brushes, buckets, etc.

K. Soil jars (laboratory grade and/or driller's grade)

L. Jar labels, marking pens (do not use water soluble ink)

M. Driller contacted and informed:
1. Health and safety plan
2. Utility check
3. Sampling plan
4. Water source: clean, high-capacity source
5. Disposal of drill cuttings and fluids
6. Decon pad construction - if necessary
7. Equipment/material storage area

N. 100' tape measure with weighted sounding device

O. Pocket penetrometer

P. Soil knife/spatula

Q. Well/Borehole Abandonment Forms

R. Monitoring Well Construction Forms

S. Well Development Forms

II. FIELD CHECKLIST

A. Check for unmarked or uncleared utilities: drive around, walk around

B. Check for overhead wires

C. Drill rig access

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D. Borehole location correctly staked and labelled

E. Steam clean augers, drill rods, samplers, hand tools, drill rig

F. Count number of augers - to determine number used during drilling and, therefore, total depth drilled

G. Count number of drill rods - to determine number used during drilling and, therefore, total depth drilled

H. Measure length of split spoon sampler/Shelby tubes

I. Measure length of lead auger

J. Confirm the correct well construction or borehole abandonment materials are present

K. Health and safety briefing

L. Soil jars prepared

M. Drill and sample the deepest hole at a well nest first, unless directed otherwise by a Work Plan

III. HOLLOW STEM AUGERING FOR WELL INSTALLATION AND SPLIT SPOON SAMPLING

A. Must have appropriately sized augers: minimum 2¼ in. I.D. to maximum 6¼ in. I.D. for split spoon sampling; minimum inside diameter of 4¼ in. greater than the nominal diameter of the well casing.

B. Must use center bit when performing split spoon sample collection for any chemical analysis. This isolates the sample interval and prevents cross contamination.

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C. Collect split spoon samples at 2½ ft intervals in the top 10 ft, then at 5 ft intervals thereafter, unless specified otherwise in Work Plan. Representative soil samples should be place in jars and retained for later review and/or analysis, unless indicated otherwise in the Work Plan. At Wisconsin LUST sites, the entire boring must be sampled at 2 1/2 in. intervals. Collect split spoon samples at each change in strata. Shelby tube samples may need to be collected in clay soils. Boreholes with adjacent previously sampled piezometers may be "blind drilled" without any soil sampling.

D. Split spoon sampling - standard penetration test (SPT).

1. Inspect split spoon.

a. Measure length of spoon from tip to shoe.

b. Spoon tip must not be gouged, bent, or excessively worn.

c. Spoon shoe must have a check valve; the check valve should be free of soil and be able to seal.

d. Spoon tip may contain a spring sample catcher which is clean and in good working order.

e. Split spoon should meet the construction specifications shown in Figure 1. If a larger split spoon is used, its diameter will be noted.

f. Split spoon should be clean: initially steam cleaned; between samples use TSP/Liquinox wash and triple rinse with clean water, if the split spoon samples are for chemical analysis.

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2. Check sampling hammer.

   a. 140 lb hammer which free falls for 30 in.; 140 lb x 2.5 ft = 350 ft-lb of torque

   b. If used with a cathead, no more than 2¼ rope turns on cathead; cathead should be free of rust, grease and oil, and should be 6 to 10 in. in diameter

   c. If using an automatic trip hammer, check the throw length and hammer fall height (30 in. free fall onto anvil)

   d. If a larger hammer is used, note the sample hammer torque

3. Check drill depth: drill depth (Dd) = length of drill string (Ld) minus stick up (SU); Dd = Ld - SU. See Figure 2

4. Driller will insert split spoon into augers and lower to the bottom in a controlled manner; do not allow the split spoon to freely drop to the bottom.

5. Check split spoon sampler depth: split spoon depth (Dss) equals length of sampler string (Ls) minus stick up (SU); Dss = Ls - SU. See Figure 3

6. The depth of the split spoon must be within 4 in. of the drilling depth before commencing the Standard Penetration Test. If the drill depth minus the split spoon depth is greater than 4 in., then do not initiate the test (Dd - Dss >4 in. → no test); the driller must clean out the borehole. Do not allow the driller to jet water thru the split spoon to advance it to the drill depth.

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7. If Dd - Dss <4 in. the test can start.

   a. The driller should measure and mark the drill rods in 6 in. increments; three 6 in. increments are normally marked, but four or more 6 in. increments may be marked should extra sample volume be desired.

   b. Driller places steel anvil onto drill rods and automatic trip hammer or places safety hammer onto drill rods. The hammer force should strike the drill rods and sampler with a metal to metal contact.

   c. Raise the sample hammer and allow it to free fall 30 in. to strike the drill rods.

   d. The driller will count the number of hammer blows required to advance the sampler through each 6 in. interval.

   e. Stop the test if the sampler fails to advance; split spoon refusal is 100 blows for 6 in. or less.

   f. Drive the sampler for 18 in. or more; record the blow counts for each 6 in. interval.

8. Pull the split spoon out of the borehole and remove it from the drill rods.

E. Handling the split spoon sample.

1. Carefully open the split spoon or have the driller do it; do not disturb the sample any more than necessary; do not slam the split spoon; use a pipe vise or pipe wrench to compress the split spoon perpendicular to its seams; unscrew the shoe first, then the tip; use a large screw driver to pry apart the split spoon.

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2. Recognize and discard any soil plug, sluff or blow-in at the upper portion of the sample.

3. Measure and record the sample recovery length (inches).

4. Use a clean spatula to place soil from the lower portion of the sample into a pre-labelled soil jar. If PID or FID field screening is required, grab this sample first (see PID/FID Headspace Screening of Soil Samples SOP). If there is a major change in lithology, samples should be subdivided and labeled as separate subsamples of a given split spoon. For example, if sample 10-SS encounters three changes in lithology, the bottom 6 in. is labeled 10-SS, the middle 6 in. is labeled 10-X, and the top 6 in. is labeled 10-XX.

5. If sampling for chemical parameters fill VOC jars first (with no headspace) then other jars before filling geotechnical jar. Wipe soil from threads of the jar samples and securely tighten the jar cap.

6. Perform pocket penetrometer test. This test must be performed when cohesive soils are encountered.

   a. For cohesive soils only

   b. 'Zero' the pocket pen

   c. Hold the pocket pen at a right angle to the soil sample surface and steadily push the piston into the soil up to the calibration groove. Read the unconfined compressive strength in tons/sq. ft. Take several readings, discard the high and low readings; record an average reading.

7. Perform Munsell soil color test (if required).
   a. Record soil hue and chroma
   b. Record soil color name
   c. Example: Brown (7.5 YR 5/2)

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8. Describe the soil sample - see Boring and Test Pit Log SOP

   a. Consistency: for cohesive soils only; determined from pocket pen readings and Warzyn's general notes; or

   b. Density: for non cohesive soils only; determined from the blow counts (N value) and Warzyn's general notes.

   c. Color: use munsell, or common language; avoid bizarre names such as 'rusty brown', 'chocolate', 'lemon yellow'; keep it simple.

   d. Major soil type with modifier: such as silty fine sand, or fine to coarse sandy lean clay.

   e. Minor soil proportions: trace, little, some according to Warzyn's general notes; such as fine sand, little silt, trace fine gravel; lean clay, little fine sand, trace fine gravel.

   f. Unified Soil Classification System: assign a USCS group symbol to the soil description; the USCS group symbol should be consistent with major and minor soil description.

   g. Describe soil moisture: use 'W' for wet (free water readily apparent), or 'M' for moist (no visible free water but soil particles adhere). Avoid using 'D' for 'damp' or 'dry' and S 'saturated'.

   h. The soil description should apply to the soil placed into the soil jar. Further describe the split spoon sample by noting other features in the split spoon. For example: If the split spoon contains alternating layers of fine sand, silt, and clay ranging from 6 in. to 1/4 in. thick and the bottom portion of the split spoon is a 6 in. clay seam, place the clay seam into the jar and describe it. But also describe the remaining portion of the soil profile in the spoon. Stiff, brown silty clay (CL-ML) moist, with alternating

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horizontal layers of wet fine sand (SP), silt (ML), and silty clay (ML-CL), 6 to ¼ in. thick, glacial lacustrine. Do not describe only the clay portion and omit the horizontal wet sand and silt seams. Do not stuff the sand and silt seams into a jar and describe the silty clay. The soil description and USCS symbol should represent the soil in the jar, but also describe other features in the spoon. The boring log should accurately reflect the soil observed, not just the soil submitted for analysis.

j. Also describe soil structure (mottled, massive, laminated, cross bedded, blocky, etc.), predominant grain shape (angular to rounded), geologic origin if apparent (glacial, aeolian, residual, etc.), and presence of silt or sand seams in clay soils or clay seams in sand soils.

k. Soil samples should be retained in jars for later review and/or testing, unless indicated otherwise in the work plan.

8. Clean and decontaminate the split spoon

a. Scrape off soil and pre-wash; check for freely working ball check valve in shoe; replace spring sample catcher in tip if necessary; check condition of tip and replace if worn

b. TSP/Liquinox wash with stiff bristled brush

c. Triple rinse with clean water

9. Assemble split spoon.

F. Shelby tube sampling.

1. Used for recovering relatively undisturbed samples of cohesive soils; also applicable to recovering larger sample volumes than a regular split spoon.

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2. Inspect Shelby tube.

   a. Sharp end

   b. Tube straight with no dents, no extruding seams

   c. Rust free

   d. Steam cleaned (if environmental boring - Shelby tubes are often coated with oil to prevent rust)

3. Inspect Shelby tube head.
   a. Check ball valve clean and in good working order
   b. Allen screws clean or spring loaded head functioning

4. Measure length of assembled tube and head.

5. Check drill depth: drill depth (Dd) = length of drill string (Ld) minus stick up (SU); Dd = Ld - SU. (see Figure 1)

6. Insert Shelby tube into the augers and lower it to the bottom in a controlled manner; do not allow the tube to free fall to the bottom.

7. Check and record Shelby tube depth: tube depth (Dst) equals length of sampler string (Ls) minus stick up (SU); Dst = Ls - SU.

8. The Shelby tube must not be pushed through the soil plug in the augers. If Dd - Dst >0, then the driller should clean out the soil plug before pushing the Shelby tube.

9. Use the rig hydraulics to advance the tube sampler without rotation using a relatively rapid continuous motion. The length of advance should be no greater than the functional inside length of the tube.

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Advance the tube until it is full or until it is refused. Record the length of advance.

10. If the formation is too hard for push type insertion the tube may be advanced using a sample hammer. However, this may risk losing the Shelby tube in the augers or borehole. If driving methods are used, record the sample hammer weight and fall length. Other methods for obtaining tube samples in hard formations are the Denison sampler and Pitcher sampler.

11. Allow several minutes before retracting the tube so the soil can develop a bond with the tube.

12. The tube may be rotated to shear bottom of the sample.

13. Pull the Shelby tube out of the augers; immediately place a cap onto the tube bottom; remove the tube from the tube head.

G. Shelby tube sample handling.

1. Remove disturbed material from the upper end of the tube: hold the tube upside down and gently tap it vertically on a hard surface until the loose material slides out

2. Measure and record the length of material in the tube

3. Use a soil spatula to remove 1 in. of material from the bottom of the tube; use this for soil description (see E, #7)

4. Perform pocket penetrometer test (see E, #5)

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5. Seal the tube ends

   a. If the tube end is crimped, cut it off using a hack saw

   b. Use end padding in end voids to prevent drainage or movement of the soil within the tube; use loosely wadded newspaper, or packing material consistent with chemical or physical analyses

   c. Cap over both ends of the tube with Shelby tube caps

   d. Wash the exterior of the tube to remove soil and contaminants

   e. Use duct tape or electrical tape to seal over the cap ends and tube holes

   f. Do not use wax to seal the tube

6. Label the sample

   a. Top end cap: job #, boring #, sample #, depth, date

   b. Side of tube: job #, boring #, sample #, depth; indicate 'This End Up' at several places on the tube; indicate the soil level in the tube with a solid ring mark

7. Shelby tube samples are very fragile; store and transport them carefully

   a. Store upright; don't let them roll around in the van

   b. Do not allow them to freeze; store away from heaters

   c. Shipping is a real problem; sometimes it is necessary to cut the tube into smaller sub samples for shipment. Clearly label and document all subsamples cut for shipping

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IV. DOCUMENTATION

A. Field boring log - see examples in Boring and Test Pit Log SOP and attachments; choose only from these options for field boring logs. Typed final boring logs are not part of this SOP.

1. Warzyn's Field Boring Log

2. Wisconsin DNR Soil Boring Log - required in Wisconsin

3. Waste Management's Field Log - Soil Borehole
   a. Required on Waste Management projects
   b. In Wisconsin, must also submit Wisconsin's DNR soil boring log

4. Other states or clients may require specific field boring logs

B. Daily Drilling Summary and Daily Project Summary - see examples in Drilling RFQ Preparation ____.

1. Used to track drill rig utilization and materials' use

2. Excellent resource to check billing and identify pay items and out of scope activities

3. Detail the drill crew's work in ¼ hr intervals and explain in 'remarks'

C. Monitoring Well Construction Summary - see well installation SOP.

D. Borehole Abandonment form - see Attachment ____.

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V. BOREHOLE DISPOSITION

A. Cover and protect incomplete boreholes
   1. Keep children or animals from falling in
   2. Keep vandals out

B. Each borehole log should have an associated monitoring well construction summary, or abandonment report

VI. BOREHOLE ABANDONMENT

A. The purpose of borehole abandonment is to completely fill the borehole so it will not act as a vertical conduit for contaminant flow, and to prevent people or livestock from falling or stepping into the hole. Document borehole abandonment using Warzyn's Well/Borehole Abandonment Form.

B. Boreholes less than 10 ft deep which do not intersect the water table may be backfilled with uncontaminated drill cuttings. If the drill cuttings are contaminated they should be contained, and the borehole should be backfilled with materials less permeable than the formation.

C. Use bentonite granules in borings less than 25 ft deep provided there is no standing water in the borehole.

D. Bentonite chips or pellets can be used in borings less than 50 ft deep provided there is less than 30 ft of standing water in the borehole.

E. For other applications, use bentonite-cement grout pumped through a tremie pipe set to the borehole bottom in any borehole. Use this mix recipe: 6 1/2 gal of water plus 94 lb Portland Type 1 cement plus 3 to 5 lb bentonite powder to yield approximately 1 1/2 times the water volume used.

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F. Record the type and volume of sealant(s) used and report the mix recipe and method placement.

G. Check for sealant settlement after 24 hr and top it off with more sealant.

H. Stake the borehole location. Before leaving the site locate the boring relative to two fixed site features (not other borings or wells) so the boring can be readily located on the site map.

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INTRODUCTION

This standard operating procedure (SOP) is for soil and rock classification, preparation of field boring and test pit logs, review of logs by professionals in our office, and preparing final logs to be included in Warzyn project reports. It is important to remember when preparing logs that the level of detail should be sufficient so that they will be adequately useful to any of our technical professionals, including hydrogeologists and geotechnical engineers. This means, for example, that soils should be classified according to the Unified Soil Classification System (USCS) based on visual observation supplemented by the results of laboratory soil index tests (such as grain-size analysis, Atterberg limits, natural moisture content, and organic content by loss-on-ignition when organic soil is suspected). In addition to standard procedures in this document, several states have specific requirements for specific purposes (e.g., Wisconsin Administrative Code, Chapters NR 141 and NR 500). These rules or guidelines should be carefully reviewed before proceeding with a drilling program and logs should be prepared in accordance with code requirements. Every borehole or test pit should have a field log prepared, regardless of whether a final log will be included in the report.

REVIEW PROCEDURE FOR QUALITY CONTROL

All field logs require review editing before they are finaled for submittal with project reports. Field logs are usually prepared by Warzyn field staff supervising the drilling or test pit excavation, or on rare occasions directly by the subcontracted drilling crew. Experienced professional staff, usually a geologist, hydrogeologist, or geotechnical engineer, need to review the field logs. The soil and/or rock samples should also be reviewed by an experienced professional when the field staff is not very experienced in sample classification or if logs are prepared by the drilling crew. When feasible, it is best to review the field logs prior to data entry into gINT (Geotechnical Integrator, a geologic/geotechnical data base; see gINT SOP for use of the gINT program). Soil descriptions based on visual observations should be edited so that they are consistent with the results of the laboratory soil tests. Prior to submittal with project reports, all data entry

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on final logs should be thoroughly checked against original data. This includes checking of stratification line depths, geologic symbols, and sample depth intervals. Both the initials of the person preparing the field logs and the person reviewing/editing the logs should be on the final logs.

SOIL CLASSIFICATION AND DESCRIPTIONS

Where feasible, the following items should be included for all soil descriptions on logs:

- consistency for cohesive soils and relative density for granular soils
- color and any mottling
- major soil proportion with the USCS symbols
- minor soil proportion
- grain angularity
- scattered/numerous constituents (such as cobbles, boulders, lenses)
- any unusual odor
- genetic descriptions, such as till or loess, if known

Check applicable state codes for specific information that may be required, such as use of the Munsell color chart.

Consistency

The consistency of a clay or cohesive silt is based on its unconfined compressive strength (Q_u or q_u value). Unconfined compressive strength can be estimated using a pocket penetrometer in the field, or from unconfined compression or unconsolidated undrained (UU) triaxial compression testing in the laboratory. On the log, the unconfined strength value is reported in ton/sq ft units, shown in parentheses to the nearest 0.1 ton/sq ft from pocket penetrometer readings (q_a), and shown without parentheses to the nearest 0.01 ton/sq ft from laboratory testing. The consistency description to be used based on these values is shown below:

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Consistency	Unconfined Compressive Strength (ton/sq ft)	Approx. N-Value
Very Soft	Less than 0.25	0 to 2
Soft	0.25 to 0.50	2 to 4
Medium Stiff	0.50 to 1.00	4 to 8
Stiff	1.00 to 2.00	8 to 16
Very Stiff	2.00 to 4.00	16 to 32
Hard	More than 4.00	More than 32

If a pocket penetrometer reading cannot be obtained for a cohesive soil sample but SPT (Standard Penetration Test, ASTM D1586) blow counts are available, the consistency can be estimated based on the range of N-values shown above.

Relative Density

The relative density of a sand, gravel or granular silt is estimated based on the SPT N-value in blows/ft (blow counts). The relative density description to be used based on the range of blow counts is shown below:

Relative Density	SPT N-Value (blows/ft)
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	Over 50

Color

Soil or rock color should always be included with the description on the log. Modifiers to the color description should also be included where appropriate, such as light, dark or mottled. Some agencies, such as the Wisconsin Department of Natural Resources, also require Munsell chart color notation.

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Major Soil Proportion

The major soil proportion in the description should be shown in all capital letters on the logs so that it stands out. Modifiers with only the first letter capitalized should also be used where appropriate. Appropriate modifiers vary depending on the soil type as indicated below:

Clay--silty, lean, fat, organic, sandy, gravelly
Silt-- organic, sandy, gravelly, elastic
Sand--fine, medium, coarse, silty, clayey
Gravel--fine, coarse, silty, clayey
Peat--sedimentary, fibrous, or woody

Clay should always be described as silty, lean, or fat depending on its known or estimated Atterberg limits values. Silt may be elastic depending on the Atterberg limits values. Clay or silt are "organic" if the known or estimated organic content is 4% or greater based on loss-on-ignition (LI) tests. Clay and silt are sandy and gravelly if the sand or gravel content, respectively, is 35% or greater but less than 50%.

When sand or gravel is the major soil proportion, it should always be described as fine, medium, and/or coarse (e.g., Fine to Medium, Fine to Coarse, or Medium to Coarse if there are a range of particle sizes). If a sand has a gravel content of 35% or greater or if a gravel has a sand content of 35% or greater, the major soil proportion in either case should be described as SAND & GRAVEL. If 35% or more (but less than 50%) of a sand or gravel soil consists of silt and/or clay, a modifier of Silty or Clayey should be used. Whether the soil is silty or clayey depends on the known or estimated Atterberg limits values.

Peat is organic soil with an organic content of more than 12% as measured by the LI test. If the organic content is between 12 and 50%, then it is described as Sedimentary PEAT. If the organic content is more than 50%, then it is described as Fibrous or Woody PEAT.

Guidelines for field classification of soil based on visual observations are contained in Table 1 and Appendix A.

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Minor Soil Proportion

Soil descriptions usually mention the minor soil proportions of silt, clay, sand and/or gravel that are often present. Modifiers to use with the minor soil proportions are the following:

Trace--5% or less
Little--5 to 12%
Some--12 to 35%

The minor soil proportion descriptions are limited to those for sand or gravel when the major proportion is clay; clay, sand or gravel when the major proportion is silt; silt, clay or sand when the major proportion is gravel; and silt, clay or gravel when the major proportion is sand.

USCS Symbols

The soil description should be followed by the USCS symbols shown in parentheses (Table 2 and Appendix B). Some examples are:

Loose, Brown Fine SAND, Little Silt (SP-SM)
Dense, Brown Fine to Coarse Sand and GRAVEL, Some Silt (GM)
Stiff, Gray Silty CLAY, Little Fine Sand (CL-ML)

For visual classification of sands and gravel with less than 12% silt and/or clay content, the USCS symbols of SP, SP-SC, SP-SM, GP, GP-GC, or GP-GM are used as appropriate rather than SW, SW-SC, SW-SM, GW, GW-GC, or GW-GM. P signifies poorly graded and W means well graded. Few natural soils are well graded. A soil should not be classified as well graded unless it is confirmed by grain size analysis testing. A well-graded sand (SW, SW-SC, or SW-SM) has a coefficient of curvature (C_c) value between 1 and 3 and a coefficient of uniformity (C_u) value of 6 or more. A well-graded gravel (GW, GW-GC, or GW-GM) has a C_c value between 1 and 3 and C_u value of 4 or more. C_c and C_u values are obtained from laboratory grain-size analysis (Appendix C).

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Grain Angularity

Describe the predominant angularity of grains larger than medium sand as angular, subangular, rounded or subrounded. A range of angularity may be stated such as rounded to subrounded.

Scattered/Numerous Constituents

Other constituents in the soil that are observed should also be noted on the logs. This includes the presence of cobbles, boulders, and lenses or layers of discontinuous soil that are not thick enough to be considered a separate major soil unit. Based on their dimensions, these constituents are described as follows:

Boulders--larger than 12 in. in diameter
Cobbles--3 to 12 in. in diameter
Layers--more than 1 in. thick
Lenses--1 in. or less in thickness

Modifiers should also be used when describing these constituents based on their frequency of occurrence. For example, use "Scattered" to mean "a few" and "Numerous" to mean "many". Avoid use of words such as "occasional" which have temporal rather than spatial significance.

Topsoil

Where feasible, topsoil should be described based on its major soil proportion using the modifiers noted above, and then adding Topsoil to the description. Use the topsoil material graphic symbol on the log and geologic cross sections (Appendix G). Usually for thin surficial topsoil layers, no attempt is made to describe its consistency or relative density. For example:

Black Organic SILT Topsoil, Trace Sand (OL) Scattered Roots

When fill overlies a topsoil layer, it should be noted as Possible Buried Topsoil or Probable Buried Topsoil, depending on the degree of confidence that the layer is buried topsoil. When buried topsoil is encountered, an attempt should be made to describe its consistency or relative density if the N-value or pocket penetrometer reading is available, particularly if the layer is more than 6 in. thick. For example:

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Stiff, Black Organic SILT (OL) Scattered Roots (Probable Buried Topsoil)

Fill

When encountered, fill should be noted in all capital letters and described as noted above for the soil constituents that are present. Sometimes the USCS symbols are omitted and no attempt is made to describe the consistency or relative density of the fill; however, the USCS symbols should be included when feasible. It should be remembered that many times fill is not placed in a controlled manner and, while one location may appear to be dense, another location nearby may be very loose. In other words, the N-values or pocket penetrometer readings in fill can be deceptive. Also, fill is often very heterogeneous material (i.e., not a uniform material type throughout the fill zone). If fill is suspected but not certain, the soil unit can be described as Possible Fill or Probable Fill depending on the likelihood that it is fill. For example:

Medium Dense, Brown Silty Fine SAND, Trace Gravel (SM) Angular Gravel (Possible Fill)

Nonsoil constituents observed in the fill should also be described, such as scattered or numerous pieces of wood, concrete or brick; or trace, little or some topsoil, cinders or roots. For example:

FILL: Brown Fine to Coarse Sand and Gravel, Some Silt and Cinders, Trace Topsoil, Scattered Pieces of Wood and Concrete

Any unusual odors should also be noted.

ROCK CLASSIFICATION AND DESCRIPTIONS

It is important to accurately and completely describe rock cores at the drill site because often the field geologist or engineer is the only person to see the cores. Rock cores should be color photographed for a permanent record, to be sent to the file or included with the report. As a minimum, the rock core descriptions should

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include color, weathering, structure, and rock type. The typical components of a rock description are listed in Table 3. Rock classification is discussed in Appendix D.

If the presence of bedrock is suspected based on rock chips collected from the split spoon or drill cuttings, and no coring is performed, then the layer should be noted as Possible Bedrock or Probable Bedrock depending on the degree of certainty. For example:

Light Brown DOLOMITE (Probable Bedrock)

A specific description of each discrete section of the core is required. Run number, run length, run depth interval, percent recovery, percent RQD (rock quality designator), and fractures per foot need to be recorded on the log. Fluid loss (depth and approximate volume) and qualitative degree of drilling difficulty should be noted where appropriate. An example rock description for a run interval on a field log is as follows:

> Run #1: 184.2 to 194.2; 9.6' recovery of gray, very slightly weathered, massive, vuggy, micritic DOLOMITE; scattered unidentified fossils; fractures are horizontal and stained brown; vugs range from 1/4 in. to 3/4 in. and are calcite filled; fractured rubble zone at 189' to 190'; thin green shale seam at 192.0' to 192.3'; lost 100 gal water at 189' to 190'; RQD=7.33/10.0=73%; 8 fractures in 10'.

While drilling, the following should be noted in the field:

- Length of core barrel and connectors.
- Number of drill rods (to accurately determine the length of a drill string).
- Core bit depth should be checked (length of drill string minus rod stickup equals the depth of the core bit).
- Note run time to determine coring rates.
- Record coring problems (for example, bit plugged at 106').
- Be aware of inconsistent rock types/mineralogies that may be present at the top of the first core run. Inconsistencies may indicate cobbles or

boulders on top of bedrock that may need to be cased off. A careful examination of rock cuttings from roller bit drilling is helpful.

LOGS IN PROJECT REPORTS

Example boring and test pit logs are contained in Appendix E.

Sheets describing the symbols and soil classification system used on the logs need to be included with project reports that contain logs. There are two standard Warzyn report insert sheets for this purpose. For both boring and test pits logs, the "Unified Soil Classification System" sheet should be included (Appendix F). The "Log of Test Boring--General Notes" sheet should also be included with boring logs (Appendix F).

Besides the Warzyn boring log format presented in Appendix E, there are other formats (gINT templates) available that are required for some projects. These include the Waste Management Inc. and Wisconsin Department of Natural Resources (Form 4400-122) formats. See the gINT SOP for details.

Geologic Symbols

A list of the material graphic symbols in use on gINT boring logs and on drawings for geologic cross sections is attached in Appendix G. This set of symbols is for use on all new projects. If additional work is being conducted on an older project, then make sure the symbols on the old and new logs are consistent. See the gINT SOP for specific use.

Water Levels and Cave In

Where possible, record the water level while drilling, before casing removal, after casing removal, and at times after drilling (such as 1/4 hr, 1 hr, 24 hr, 2 days, etc). If the borehole or test pit does not contain water, use the notation NW for no water rather than "dry".

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Elevation

The measuring point for all samples should be taken as ground surface at the boring. If a drilling platform is more convenient, then the correction between the measuring point and ground surface is required for every depth measurement.

Record the ground surface elevation to the nearest 0.1 ft. Casing and pipe elevations for wells and piezometers are recorded to the nearest 0.01 ft. This is typically available by surveying after completion of the boring or well. Boring locations without wells should be restaked after completion of drilling to clearly mark the boring for surveying unless locations were surveyed and staked prior to drilling and the boring was performed at the staked location. If the borehole has caved, note the depth to cave-in and whether it was caved and moist, or caved and wet.

Drilling Dates

Note both the start and end dates on both the field and final logs (for example, drilling of some boreholes may take several days).

Rig Type

Note the type of drilling rig that was used, such as CME 75. Avoid using rig identification numbers that are assigned by a specific drilling company.

Initials of Personnel

Record the name or initials of the drilling company and crew chief, the borehole logger, and the professional who performed final editing of the log.

Drilling Method

Try to use only the drilling and sampling symbols shown on the "Log of Test Boring--General Notes" sheet in Appendix F. For example, WB is driller shorthand for wash boring. Our symbol on the final log would be RB/CW for roller/rock bit with clear water, or RB/DM if drilling mud was used (such as bentonite). Casing diameter and length should also be noted when casing is driven; for example, DC(4") 0-8', for 4-in. diameter casing driven to 8 ft. A typical drilling method description might consist of the following:

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4 1/4" ID HSA 0-10', DC(6") 0-8', RB/CW 10.40', RC/HQ 40.50'

which indicates a hollow stem auger was used to drill to 10 ft, then casing was driven to 8 ft. The drilling method was switched to roller bits with clear water from 10 to 40 ft. From 40 to 50 ft, rock was cored with an HQ-size core barrel. Indicate when earth drilling is performed without sampling and indicate which other log, if any, has relevant descriptions from sampling. False starts and obstructions should also be noted.

Soil Sample Designation

For soil samples, record the sample number, type (such as split spoon or Shelby tube), recovery in inches, moisture (such as M for moist or W for wet), depth interval, and blow counts for split spoon samples. Do not use D for dry; dry means a moisture content of approximately 0% which is not the case for soils in the ground except possibly at the surface or for drilling in a desert. Do not use 'DAMP' or 'S' for Saturated. Sampler graphic symbols in use on gINT boring logs are attached in Appendix G. See the gINT SOP for specific use.

Blow counts are recorded for each 6 in. increment of drive of the split spoon (ASTM D1586). Usually the split spoon is driven a total of 18 in. for each sample. The SPT N-value is the sum of the blow counts recorded for the second and third 6 in. intervals. For example, blow counts of 5, 12, and 13 for a total of 18 in. of drive give an N-value of 25 blows/ft. If continuous samples are taken (24 in. of split spoon drive at 2 ft depth intervals), blow counts are recorded for each 6 in. increment, but the N-value is the sum of the counts from 6 to 12 in. and from 12 to 18 in. (again, the second and third increments). For example, blow counts of 5, 12, 13, and 14 for a total of 24 in. of drive give an N-value of 25 blows/ft. If a 3-in. diameter split spoon is used instead of the standard 2 in. split spoon, this should be noted on the log because the N-value is not a true SPT result. The SPT is defined in terms of blow counts from a 2 in. split spoon. Also record any frozen soil encountered because the frozen state may affect the SPT N-value that is obtained compared to the nonfrozen condition.

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If refusal of the split spoon is encountered, then both the number of blows and inches of drive should be recorded. 100 blows in one foot or less is usually considered to be split spoon refusal. For example:

N-value=100/3" for 100 blows in the first 3 in.;
Blow counts of 33, 52, and 48/4" yield 100/10" for the N-value.

SOIL TEST RESULTS

Usually the unconfined compressive strength for cohesive soils, natural moisture content, Atterberg limits, P200 content, and loss-on-ignition values obtained for soil samples are recorded on boring logs when they are available. When several different laboratory tests are desired on a sample, multiple sample jars or containers are sometimes required.

Natural Moisture Content (W) and Loss on Ignition (LI)

These are recorded to the nearest 0.1% on the log. The typical sample volume required to perform these tests in the laboratory is about that of an 8-oz jar sample (i.e., split spoon sample size).

Atterberg Limits (LL and PL)

These values are reported to the nearest 1%. LL is liquid limit and PL is plastic limit. Plasticity index (PI) is determined by subtracting PL from LL. PI is not shown on the logs, but it is an important index parameter and should not be confused with PL. A minimum sample volume that is required to perform this test in the laboratory is about that of an 8-oz jar sample.

P200 Content (P200)

This value is reported to the nearest 0.1%. P200 content is the percent of material by weight passing the No. 200 U.S. standard sieve. P200 defines the amount of fines (clay and silt) in a soil sample. A minimum sample volume that is required to perform this test in the laboratory is about that of an 8-oz jar sample.

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Other Laboratory Soil Tests

Usually other laboratory soil test results that may be determined, such as Proctor values and permeability (hydraulic conductivity), are not reported on the boring logs. It should be noted that sample volumes required for these tests are quite large (i.e., greater than an 8-oz jar or split spoon sample). Compositing of samples or obtaining auger samples, for example, to supplement split spoon samples may be necessary to achieve the required volume. Typically a minimum of 35 lb of soil are required for a Proctor test, or about the volume of a 5 gal pail. A permeability test maybe performed on a Shelby tube sample (relatively undisturbed specimen) or on a remolded specimen. If a remolded permeability test specimen is needed, then about 7 lb of soil should be obtained if the material is clay or silt, 12 lb if the material is fine sand, and 5 gal if the material is sand and gravel.

If Shelby tube samples are obtained, they require special handling to maintain the relatively undisturbed state. Seal the tubes against moisture loss, store in an upright position, protect against shaking/vibration, and protect from freezing temperatures. Tube samples should only be shipped in special crates or boxes designed to minimize vibration disturbance.

Submittal of soil samples for testing will be covered in more detail in an SOP for the Warzyn Geotechnical Laboratory.

[mad-sop-247]

TABLES

TABLE 1

FIELD IDENTIFICATION TESTS FOR COHESIVE SOILS

Plasticity

Add water or allow to dry sufficiently until the soil can be worked in the hands and remolded without sticking to the fingers. Roll a piece of soil, about the size of a caramel, in your hand into a thread approximately 1/8 in. in diameter.

High Plasticity Clay (Fat Clay)

Thread can be remolded into a ball and the ball easily deformed without cracking or crumbling.

High Plasticity Silt (Elastic Silt)

Thread can be remolded into a ball and the ball deformed, but the ball will crack slightly and resist deformation.

Low Plasticity Clay (Lean Clay)

Thread can be remolded into a ball, but the ball will crack and easily crumble under pressure.

Low Plasticity Silt (Silt)

Thread cannot be remolded into a ball without completely breaking apart.

Organic Soils (Organic Silt or Clay)

Soils containing organic materials will form soft spongy threads or balls.

Dilatancy

Dilatancy of soils, or the release of moisture upon agitation, indicates low to non-plastic materials. Dilatancy can be determined by adding sufficient water until the soil is quite sticky. A pat of soil is placed in the palm and jarred against the other hand. The soil is said to have given a reaction when water comes to the surface, producing a shiny appearance. Upon squeezing the sample, the surface water will disappear, giving a dull surface. Because it is rare to find silt or fine-grained samples without some amount of clay, there are varying degrees of reaction:

Sudden Reaction -	Typical of non-plastic fine sands or silt.
Slow Reaction -	Indicates a slight plasticity such as might be found in silty clays or organic silts.
No Reaction -	Indicates clays.

Dry Strength

Mold a pat of soil to about the consistency of putty by adding water as necessary. Allow the pat to completely dry and then test the crushing strength by breaking or crumbling between the fingers:

High Plasticity Clay (Fat Clay) - High crushing strength

High Plasticity Silt (Elastic Silt)
and Low Plasticity Clay (Lean Clay) - Less crushing strength

Silts, Organic Soils and Silty Fine Sands - Very low to no crushing strength.

Sedimentation

Place a palm full of representative soil into a glass sample jar and fill with water. Vigorously shake for about one minute and allow to stand:

Gravel and Coarse Sand - Will settle instantly

Medium to Fine Sand - Will settle in 1 to 3 minutes

Silt - Will settle within about 15 minutes

Clay - Will take slightly longer than 15 minutes

The relative thickness of the sediments is an indication of the percentages of the various grain sizes.

Feel

Sandy - Rough and gritty.

Silty - Not particularly gritty, but noticeable. Dry soil on hands will easily scrape off.

Clayey - Smooth texture. Dry soil on hands will not easily scrape off.

Shine

High Plasticity - Will give a definite shine when a moistened sample is rubbed with the fingernail.

Low Plasticity - Will give a dull appearance.

Note: Refer to ASTM D2488 for further details.

DLN/mdj/RHW
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TABLE 3

ROCK DESCRIPTION COMPONENTS

A. Weathering

Fresh	Rock fresh, crystals bright, few joints may show slight staining.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks, some scattered feldspar crystals are dull and discolored.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil." Rock "fabric" not discernible or discernible only in small scattered locations. Quartz may be present as dikes or stringers.

B. Color

C. Structure

1. Massive - Homogeneous Structure
2. Stratified - Layered Strata ≥ 1 cm
3. Foliated - Metamorphic: Parallel Fabric Fine Grained

4. Schistosity - Metamorphic: Parallel Fabric Coarse Grained
5. Jointed - Vertical or transverse fracture along which no movement has occurred.
6. Laminated - Layering ≤ 1 cm
7. Sparitic - Coarse Crystalline Texture
8. Micritic - Very Fine Crystalline Texture

Joint Bedding and Foliation Spacing in Rock

Spacing	Joints	Bedding and Foliation
Less than 2 in.	Very close	Very thin
2 in.-1 ft	Close	Thin
1 ft-3 ft	Moderately close	Medium
3 ft-10 ft	Wide	Thick
More than 10 ft	Very wide	Very thick

Joint spacing refers to the distance normal to the plane of the joints of a single system or "set" of joints that are parallel to each other or nearly so. The spacing of each "set" should be described, if possible to establish.

D. Rock Type: Dolomite, sandstone, granite, mica-schist, etc.

E. Vertically or horizontally fractured zones.

F. Scattered Occurrences - Chert lenses or seams, pyrite, calcite-filled or vacant vugs, shale seams, pitting, fossiliferous zones, etc.

G. Coring Information - Report as much information as possible.

Most Important:

Beginning of run
End of run
Run number
% recovery
% rock quality designator (RQD)
Fracture frequency (e.g., fractures/ft)
Water loss
Core loss in inches
Core gain in inches

Less Important:

Drilling time
Hydraulic pressure
Water pressure
Revolutions per min ((rpm))
Drilling rate ((ft/min))
Drilling action

C

ENSYS INC. PCB RIS SOIL TEST METHOD

Effective Date: 1-13-92

FIELD ANALYSIS OF VOLATILE ORGANICS

Scope and Application: This method covers the determination of the following organic compounds in water and soil gas.

Target Compounds:

Benzene	trans-1,2-Dichloroethene	Trichloroethene
1,1-Dichloroethane	Ethyl benzene	m-Xylene
1,2-Dichloroethane	Tetrachloroethane	o-Xylene
1,1-Dichloroethene	Toluene	p-Xylene
cis-1,2-Dichloroethene	1,1,1-Trichloroethane	

Note: m-xylene and p-xylene are not separated by this method. Therefore the sum of the unresolved peaks are reported.

Method: Headspace - Gas Chromatographic/Photoionization and Hall Electrolytic Conductivity Detection.

Reference: "EPA Test Methods for Evaluating Solid Waste", SW-846 Methods 3810, 8010 and 8020 with modifications.

Reporting Limits: See table 1

Optimum Range: Headspace 5.0-50 ug/L of water, soil gas 5.0-50 ug/L of soil gas.

Sample Handling: Water samples are to be collected in 40 mL vials with open screw-caps and teflon faced silicone septa. They should be collected so that no headspace remains in the bottle. Soil gas samples are to be collected in 250 mL glass bulbs in a manner that provides the complete purging of the bulb. All samples should be protected from sunlight and transported to the field lab as soon as possible.

Reagents and Apparatus:

1. Open screw cap 40 mL vial (Pierce #13075 or equivalent).
2. Septum - Teflon-faced silicone (Pierce #12722 or equivalent).
3. 250 mL gas sampling bulbs.

4. Gas chromatograph - Varian 3400 equipped with PID and Hall detectors in series.

5. Column 1 - 8-ft x 1/8-in. stainless steel, packed with 1% SP 1000 on Carbopack B (60/80 mesh).

6. Dual-channel Integrator/Recorder.

7. Syringes - 1 and 5 mL gas tight, fitted with shut-off valves and 22 gauge needle. 10, 100, and 1,000 mL gas tight syringes.

8. Balance - $\pm$ 0.0001 g.

9. Balance - $\pm$ 0.01 g.

10. Reagent water - organic free water or cold tap water which has been shown to be organic free at the method detection limit.

11. 25 mL TC graduated cylinders.

12. Constant temperature water bath - 55^{o}C.

13. Volumetric flasks - assorted.

14. Pipettes - assorted.

15. Standard reference materials $\rightarrow$ Chem Service

16. Screw top vials - 10 mL

17. Mininert valves caps lined with teflon.

Standard Preparation:

1. **Stock standard solutions:** Prepare a VOC standard containing the target analytes at 5000 ug/mL in methanol.

    - Add about 20 mL of methanol to a 25 mL volumetric flask. Allow the flask to stand unstoppered until the methanol on the neck of the flask has dried. Replace the stopper.

    - Tare the flask on the analytical balance.

- Remove the stopper and, using a 100 uL syringe, add 0.125 g (correct for % purity) of the reference material to the flask. Make sure the drops fall directly into the methanol without contacting the neck of the flask. Replace the stopper.

- Determine the amount of reference material added. Rinse the syringe with methanol, tare the flask, and add the next standard.

- After all the reference materials are added, fill to volume with methanol, cap and invert to mix.

- Transfer the final stock standard into a screwtop vial and cap the using a mininert valve teflon cap.

2. **Secondary Standard Solutions**

Prepare secondary target standards according to the following scheme:

Standard	mLs	Final Volume	Concentration
5000 ug/mL	1 mL	10 mL	500 ug/mL
500 ug/mL	1 mL	10 mL	50 ug/mL
50 ug/mL	2 mL	10 mL	10 ug/mL

Dilute to the volume with methanol and transfer into a screwtop vial with mini inert valve teflon cap.

Note: Stock standards and secondary standards should be prepared before going out into the field. This will reduce in the necessary equipment needed on-site.

3. **Working Headspace Calibration Standards:** Prepare working calibration standards according to the following scheme:

Secondary Standard	Amount	Final Volume	Concentration
500 ug/mL	20 uL	200 mL	50 ug/L
50 ug/mL	40 uL	200 mL	10 ug/L
50 ug/mL	20 uL	200 mL	5 ug/L

Fill a 200 mL volumetric flask with reagent water to the mark. Directly inject the secondary standard into the water with an appropriate microliter syringe.

Invert each standard 3 times, discard the first 10 mL in the neck of the volumetric and transfer aliquots of the freshly prepared working standards to 40 mL VOC vials, (No headspace) and cap.

Calibration: Target Headspace Standards

1. Remove and discard approximately 10 mL from a freshly prepared standard and place the vial (capped) now having about 10 mL of headspace in a 55°C water bath with the water level sufficient to equal the water level in the vial.

2. Allow time for equilibration of temperature (10 minutes).

3. Through the septum of the vial, using a 5 mL gas tight syringe with needle remove 5 mL of headspace gas for injection into the gas chromatograph.

4. Construct an external standard curve of peak area response versus concentration for each of the compounds of interest.

5. A calibration check is performed after each set of 10 samples and as the last sample of the day. If the response for any of the target compounds varies from the calculated response by more than ± 30%, a new calibration curve should be prepared.

Soil Gas (Total Nanograms):

1. Inject 5.0 uL of the 5 ug/mL standard into the gas chromatograph.

2. Use a 1-point standard curve of peak area response versus total nanograms injected for each of the compounds of interest.

3. A calibration check is performed after each set of 10 samples and as the last sample of the day. If the response for any of the compounds varies from the expected response by more than ± 30%, the average response should be used.

Sample Analysis:

Water Samples:

1. Water samples are received in 40 mL VOC vials. Uncap and decant 10 mL of the sample from the vial. Recap the vial containing 30 mL of sample.

2. Place vials in a 55°C water bath and allow to equilibrate for 10 minutes.

3. Through the septum of the vial, using a 5 mL gas tight syringe with needle remove 5 mL of headspace gas for injection into the gas chromatograph.

4. If any compound of interest is outside the calibration curve **and an accurate concentration is required,** a dilution of the sample is made using organic free water and a fresh vial of sample. The headspace analysis is then repeated.

Soil Gas Samples:

1. Soil gas samples will be received in 250 mL glass bulbs. When received, they are allowed to equilibrate to the ambient air temperature.

2. Remove 5 mL of soil gas through the sampling septum and inject into the gas chromatograph.

3. If any compound of interest is outside the calibration curve and an accurate concentration is required, a smaller aliquot is taken from the same sample bulb.

Chromatographic Conditions:

Column: 8-ft x 1/8-in stainless steel, packed with 1% SP-1000 on Carbopack B (60/80 mesh).

Carrier Gas: Helium - Ultra High Purity Grade (Linde) 35 mL/min

Detectors: (in series)

1. Photoionization 10.2eV

   Sensitivity - Range 11 x Attenuation 8
   Temperature - 240°C

2. Hall 700A

   Mode - Halogen
   Reactor Temperature - 1000°C
   Solvent Flow - 0.8 mL/min Methanol
   Hydrogen Flow - 60 mL/min

Injector: Temperature - 200°C

Oven*: Initial - 60° - 0 min
Rate 20°C/min
Final - 200°C - 7 min

* Conditions listed can be varied as needed for changing applications.

Headspace Calculations:

1. Review the chromatograms and data reports for each analysis. Check for gross errors such as incomplete data reports because of faulty integration.

2. Prepare external standard calibration curves for each compound using at least three data points and linear regression analysis.

3. Calculate the concentration found in the samples from the calibration curves using the following equations:

$$ug/L = A \times DF$$

where: A = Amount of compound found in the analysis in ug/L (from linear regression). DF = Dilution factor.

Soil Gas Bulb Calculations:

1. Review the chromatograms and data reports for each analysis. Check for gross errors such as incomplete data reports because of faulty integration.

2. Calculate the mass per liter of each parameter found in the samples using the following equation.

$$ng/L = \frac{R(samp) \times ng(std)}{R(std) \times VL}$$

where: R(samp) = Response of parameter in sample
R(std) = Response of parameter in standard
ng(std) = ng of standard injected
VL = Volume of aliquot taken from bulb (in L)

Data Reporting:

1. All results, standards conditions, and notes will be recorded in a bound field notebook.

2. All data generated by field G.C. will be considered as tentatively identified, with concentration being estimated.

3. All raw field data will be forwarded to Warzyn Inc., Analytical Laboratory for final review and archiving.

Quality Control:

1. Each analytical run should begin with a headspace standard curve consisting of 50, 10, 5 ppb and a blank. Every eleventh analysis thereafter and the last sample analyzed should be a 10 ppb standard. Continuing calibration standards should be within $\pm$ 30% of the original standards or a new standard curve should be prepared and samples analyzed since the last check standard reanalyzed.

2. Direct inject 5 uL of a 5 ug/mL target standard (25 ng) for a 1-point soil gas curve.

3. A minimum of 10% duplicate samples should be analyzed. If less than 10 samples are analyzed, a duplicate sample should still be analyzed. Duplicates should be within $\pm$ 15%.

4. New stock standards should be prepared monthly in the laboratory. New secondary standards should be prepared weekly in the laboratory and brought to the field location while maintaining a temperature of approximately $4^{o}C$ (iced).

TABLE 1

Target VOC Reporting Limits for Water Headspace

Compound	Reporting Limits (ug/L of water)
Toluene	5.0
1,1-Dichloroethene	5.0
Trans-1,2-Dichloroethene	5.0
Trichloroethene	5.0
Tetrachloroethene	5.0
Benzene	5.0
Ethyl Benzene	5.0
1,1,1-Trichloroethene	5.0
1,1-Dichloroethane	5.0
1,2-Dichloroethane	5.0
cis-1,2-Dichloroethene	5.0
m+p-Xylene	5.0
o-Xylene	5.0

Soil Gas Reporting Limits

Compound	Reporting Limits (ug/L of soil gas)
Toluene	5.0
1,1-Dichloroethene	5.0
cis-1,2-Dichloroethene	5.0
Trans-1,2-Dichloroethene	5.0
Trichloroethene	5.0
Tetrachloroethene	5.0
Benzene	5.0
Ethyl Benzene	5.0
1,1,1-Trichloroethene	5.0
1,1-Dichloroethane	5.0
1,2-Dichloroethane	5.0
m+p-Xylene	5.0
o-Xylene	5.0

SOIL SAMPLE ADDENDUM
FIELD ANALYSIS OF VOLATILE ORGANICS

Scope and Application
This addendum to the SOP "Field Analysis of Volatile Organics" (BC-FGC), as presented in Appendix C3 of the approved June 1992 Beloit QAPP, covers the determination of 17 organic compounds in soils.

Reference
"EPA Test Methods for Evaluating Solid Waste", SW-846 Methods 3810, 8010 and 8020 with modifications.

Reporting Limits
See Table 1.

Optimum Range
Soil 15 to 150 ug/kg of soil.

Sample Handling
Soil samples are to be collected in 4 ounce wide mouth glass jars with teflon seals. The soil should be packed into the jar so that no headspace remains. All samples should be protected from light and transported to the field lab as soon as possible. Samples should be kept cool until they can be analyzed.

Sample Analysis:
Soil Samples:

1. Soil samples are received in 4 ounce wide mouth glass jars. Uncap, and weigh out 10.0 grams of soil into a 40 mL VOC vial. Remove the soil directly against the top of the jar prior to taking sample aliquot.

2. Add 20 mL of reagent grade water and cap the vial with the teflon faced silicon septum.

3. Shake the vial for 15 seconds.

4. Place the vial in a 55°C water bath and allow the sample to equilibrate for 10 minutes.

5. Through the septum of the vial, using a 5 mL gas tight syringe with needle, remove 5 mL of headspace gas for injection into the gas chromatograph.

6. Construct an external standard curve of peak area response versus concentration for each of the compounds of interest.

7. If the sample response for any target compound is exceeds the response for the high standard, a smaller aliquot can be taken from a freshly prepared sample.

8. A calibration check is performed after each set of 10 samples and as the last sample of the day. If the response for any of the compounds varies from the expected response by more than $\pm$ 30%, a new calibration curve should be prepared.

Soil Sample Calculations

1. Review the chromatograms and data reports for each analysis. Check for gross errors such as incomplete data reports because of faulty integration.

2. Prepare external calibration curves for each compound using at least three data points and linear regression analysis.

3. Calculate the concentration found in the samples from the calibration curves using the following equation:

   ug/Kg = A x DF

   where:
   A = Amount of compound found in the analysis in ug/Kg (from linear regression).
   DF= Dilution factor. DF is calculated as the ratio of water to soil:

   DF = (grams Sample + mL water)/ grams sample

   (e.g., For soil samples prepared using 10.0 grams of soil and 20 mL water, DF = ((10.0 + 20) / 10) = 3.)

JAH/Mr/PML

[mad-607-179e]
1526892/15197

TABLE 1

Target VOC Reporting Limits for Soil Headspace

Compound	Reporting Limits (ug/Kg)
Toluene	15
1,1-Dichloroethene	15
trans-1,2-Dichloroethene	15
Trichloroethene	15
Tetrachloroethene	15
Benzene	15
Ethyl benzene	15
1,1,1-Trichloroethane	15
1,1-Dichloroethane	15
1,2-Dichloroethane	15
cis-1,2-Dichloroethene	15
m+p Xylene	15
o Xylene	15

JAH/vlr/PML
[mad-607-179e]
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D

FIELD GAS CHROMATOGRAPHY SOP

ENSYS INC.
ENVIRONMENTAL PRODUCTS

PCB RISC® SOIL TEST SYSTEM

RAPID IMMUNOASSAY SCREEN

User's Guide

IMPORTANT NOTICE

This method correctly identifies 95% of samples that are PCB-free and those containing 1 ppm or greater of PCBs. A sample that develops less color than the standard is interpreted as positive. It contains PCBs. A sample that develops more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of polychlorinated biphenyls. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

TROUBLESHOOTER GUIDE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WASH STEP

Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. Solution: Make sure to wash four times vigorously, washing the whole set of 12 tubes at once.

PIPETTE CALIBRATION

An out-of-calibration pipette may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume. *Solution:* Check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipette is out of calibration is if the gold barrell is loose and will turn. (When set on 30 µl there should be about a 1/4 of an inch between the white plunger and the end of the clear pipette tip.)

AIR BUBBLES IN THE PIPETTE

The presence of air bubbles in the pipette tip when transferring extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes. *Solution:* Quickly examine the pipette tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the bubble iof necessary.

MIXING

Lack of thorough mixing, when instructed, can cause inconsistent results. *Solution:* Observe the times in the instructions and mix with sufficient force to ensure that the liquid is homogenous.

TIMING

It is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the tests. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

ADDITION OF DROPS

It is important to carefully count out the drops added in the color development steps. The addition of ±1 drop to the instructed 5 drops can cause variability in the results RIGHT AROUND THE DETECTION LEVELS OF INTEREST. One drop less would result in darker color (a less dilute solution) which could result in a false negative. One drop more would result in a lighter color (a more dilute solution) and result in a false positive.

WIPING THE TUBES

Wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

MIXING LOT #'S

Never mix lots! Each kit's components are matched for optimal performance and may give inaccurate results with the components from other kits with different lot #'s. Also, NEVER mix components from different types of kits (ex: Petro kit buffer can not be used with a PAH kit).

STORAGE AND OPERATING TEMPERATURES

Temperature requirements are very important and should be strictly adhered to. This test kit should be stored at less than 80°F/27°C and operated between 40°F/4°C and 90°F/32°C.

SHELF-LIFE

Each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

WORKSTATION SET-UP

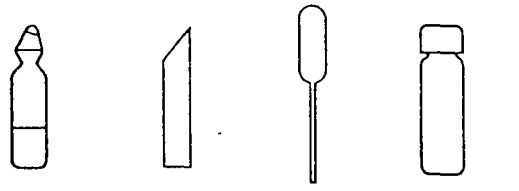
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Follow diagram below to setup workstation.
- Items that you will need that are not provided in the test kit include: a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, disposable gloves.
- Do not expose reagents to direct sunlight.
- Do not attempt to run more that 12 tubes, two of which must be Standard tubes.
- Operate test at temperatures greater than 4°C / 40°F and less than 32°C /90°F.
- See table on page 10 for sensitivity to various aroclors.

TEST PREPARATION

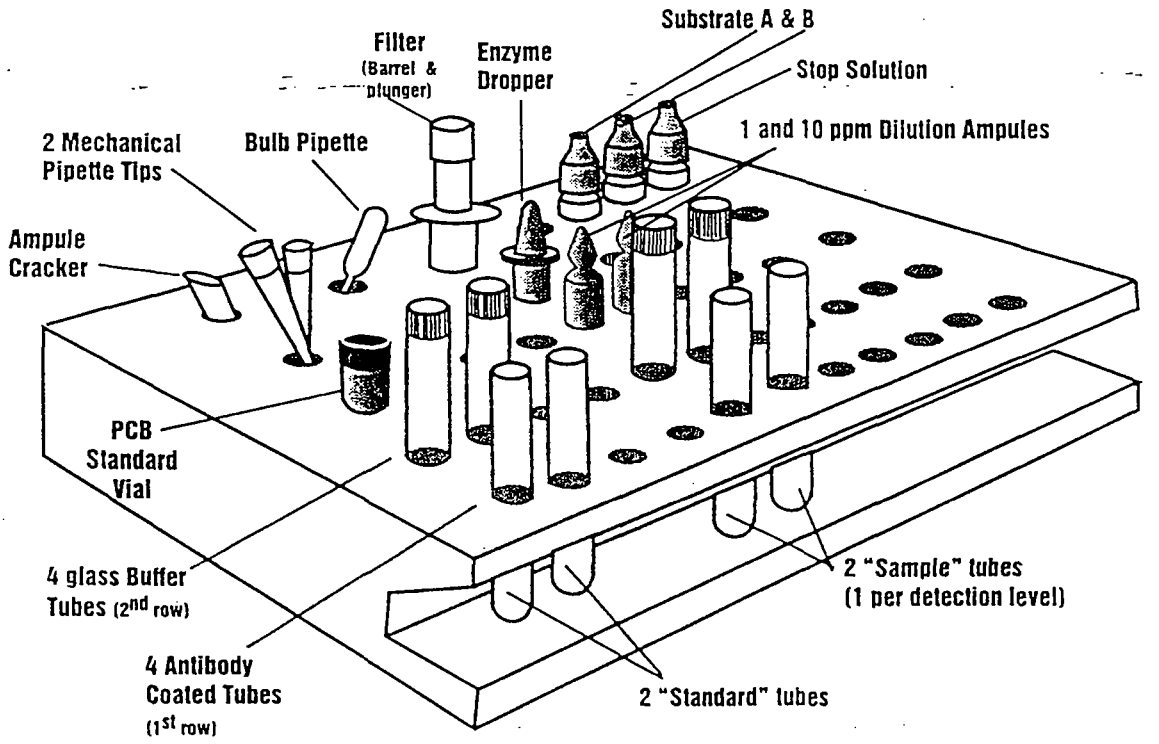
- Label amber vial "PCB Standard", and the current date, Standard is usable for up to 2 weeks from this date. Open PCB Standard ampule by slipping ampule cracker over top, and then breaking tip at scored neck. Transfer to empty amber vial with bulb pipette. Always cap tightly when finished using Standard.



PCB Standard | Ampule Cracker | Bulb Pipette | Amber Vial

WORKSTATION SET-UP (Workstation shows components for 1 sample tested at 2 levels)

- ☐ Mechanical pipette tips
- ☐ Enzyme dropper
- ☐ PCB standard vial
- ☐ Substrate A
- ☐ Filtration barrel & plunger
- ☐ 1 and 10 ppm dilution ampules
- ☐ Substrate B
- ☐ Bulb pipette
- ☐ 4 glass buffer tubes
- ☐ Stop solution
- ☐ Ampule cracker
- ☐ 4 antibody coated tubes

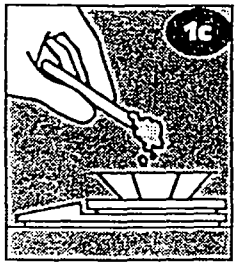


PHASE 1

EXTRACTION & PREPARATION OF THE SAMPLE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

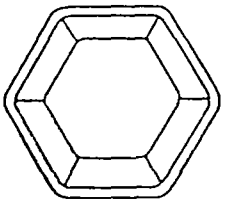


1a Place unused weigh boat on pan balance.

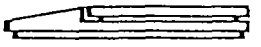
1b Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

1c Weigh out 10 ± 0.1 grams of soil.

1d If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



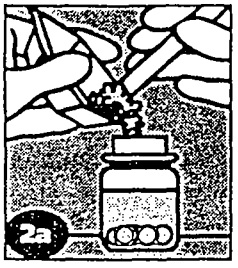
Weigh Boat



Pan balance

Wooden spatula

EXTRACT PCBS



2a Uncap extraction jar and place on a flat surface. Without contacting solvent puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.

2b Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

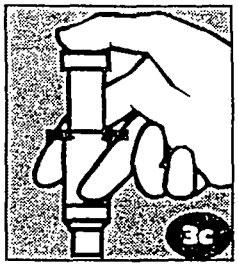
2c Recap extraction jar tightly and shake **vigorously** for one minute.

2d Allow to settle for one minute.

Repeat steps 1a - 2c for each sample to be tested.

Extraction Jar

FILTER SAMPLE



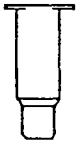
3a Disassemble filtration plunger from filtration barrel.

3b Insert bulb pipette into top (liquid) layer in extraction jar and draw up sample. Transfer **at least ½ bulb capacity** into filtration barrel. **Do not use more than one full bulb.**

3c Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).

Repeat steps 3a - 3c for each sample to be tested.

Filtration plunger



Filtration barrel

Bulb pipette

READ TO AVOID COSTLY MISTAKES

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SAMPLE DILUTION PROGRAM

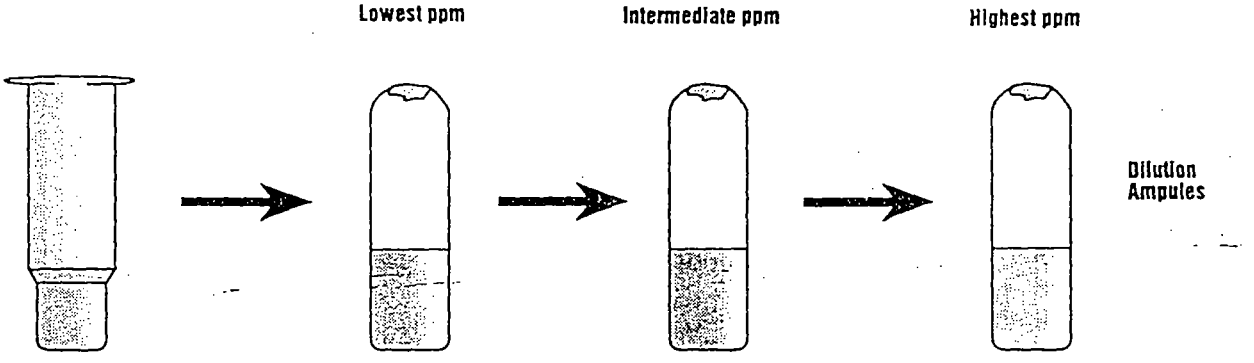
1. The sample dilution procedure on the next page is for standard detection levels. The following diagram represents the sample dilution procedure for all other detection levels.

2. Your kit may include extra dilution ampules to reach high detection levels.

3. EVERY AMPULE PROVIDED MUST BE USED!

If there are any questions concerning the dilution procedure please call Technical Services before running the samples to help avoid costly mistakes.
1-800-242-7472 or 919-941-5509 (option "4").

EXAMPLE:



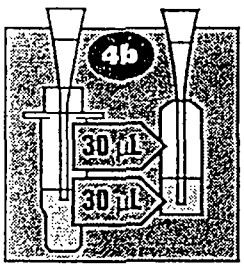
NOTE: Your Kit may include additional ampules in order to achieve your test levels. Always transfer filtered sample to the dilution ampule labeled with the lowest PPM level and then transfer from this ampule to the next higher level dilution tube.

PHASE 2
SAMPLE & STANDARD PREPARATION
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Tap glass buffer tubes vigorously on hard surface to release buffer trapped in cap.
- Label the glass buffer and plastic antibody coated tubes with a permament marking pen. Uncap glass buffer tubes.
- When using the mechanical pipette always withdraw and dispense below the liquid level.
- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

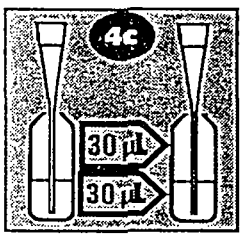
DILUTE SAMPLES AND STANDARDS



1 ppm

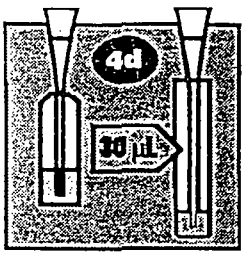
4a Open 1 and 10 ppm dilution ampules by slipping ampule cracker over top, and then breaking top at scored neck.

4b Withdraw 30 µL of filtered sample using mechanical pipette and dispense below the liquid level in "1 ppm" dilution ampule. **Repeat** to transfer a total of 60 µL; gently shake ampule from side to side for 5 seconds to mix thoroughly.

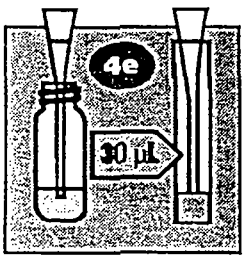


1 ppm 10 ppm

4c Withdraw 30 µL from the "1 ppm" dilution ampule using mechanical pipette and dispense below the liquid level in "10 ppm" dilution ampule. **Repeat** to transfer a total of 60 µL; gently shake ampule from side to side for 5 seconds to mix thoroughly.



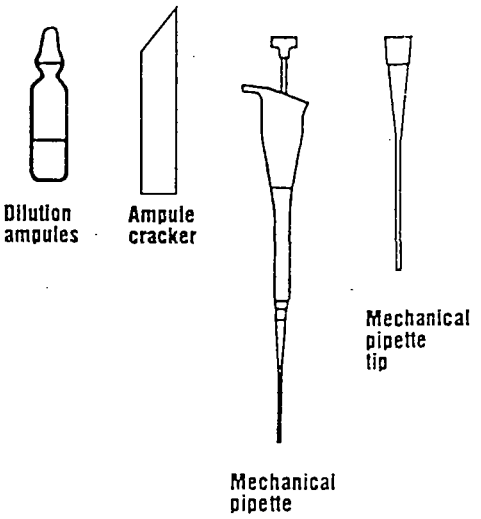
4d Transfer 30 µL from each dilution ampule into a glass buffer tube. Always wipe tip after dispensing into buffer tube.



PCB Standard

4e Assemble new pipette tip on mechanical pipette and transfer 30 µL from Standard vial into two glass buffer tubes. Immediately replace cap on PCB Standard vial.

4f Shake all glass buffer tubes for 5 seconds.

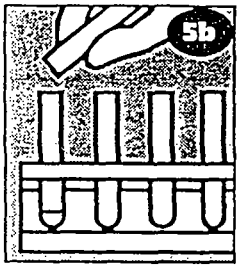


PHASE 3
THE IMMUNOASSAY
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- This phase of the procedure requires critical timing and care in handling the antibody coated tubes.

INCUBATION 1



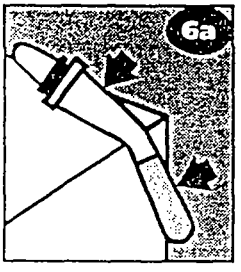
5a Set timer for exactly 10 minutes.

5b Start timing and immediately pour solution from each glass buffer tube into appropriate antibody coated tube. **Tap glass tube on antibody coated tube to remove solution.**

5c Shake all tubes for 5 seconds.

Antibody coated tubes (contained in resealable "zip-seal" aluminized pouch)

PREPARE ENZYME DROPPER

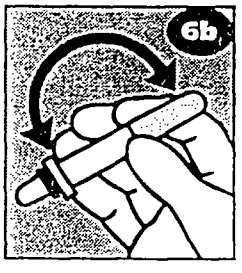


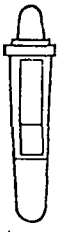
6a Crush glass ampule contained within enzyme dropper by pressing tube against hard edge.

6b Mix enzyme by turning dropper end-over-end 5 times. Do not shake.

6c Remove seal from enzyme dropper.

Repeat steps 6a - 6c to prepare one enzyme dropper for every 5 antibody coated tubes.



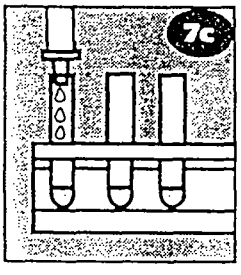


Enzyme dropper

INCUBATION II

7a Dispense first drop from enzyme dropper into liquid waste container.

Note: before dispensing drops, tap capped tip on hard surface to avoid dispensing air bubbles.



7b After the 10 minute incubation, set timer for 5 minutes.

7c Immediately dispense 3 drops of enzyme into each antibody coated tube by squeezing the dropper.

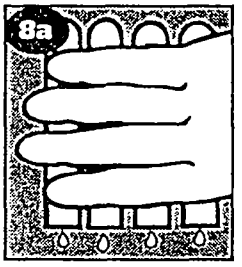
7d Shake antibody coated tubes for 5 seconds.

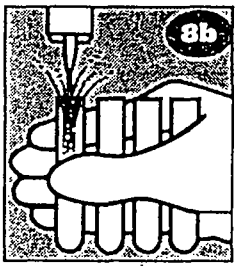
PHASE 3
THE IMMUNOASSAY
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING
WASH PROCEDURE

- An accurate test requires a virgorous wash accomplished by directing a strong stream into the antibody coated tubes.
- The wash solution is a harmless, dilute solution of detergent.

WASH



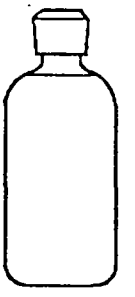


8a After the 5 minute incubation (a total of 15 minutes), empty antibody coated tubes into liquid waste container.

8b Wash antibody coated tubes by vigorously filling and emptying a total of 4 times.

8c Tap antibody coated tubes upside down on paper towels to remove excess liquid. Residual foam in the tubes will not interfere with test results.

Note: When running up to 12 antibody coated tubes, tubes can be washed in two groups - one group immediately following the other group.



Wash bottle

READ BEFORE PROCEEDING

- Keep Substrate dropper bottles vertical and direct each drop to bottom of antibody coated tubes. Addition of more or less than 5 drops may give inaccurate results.
- This phase requires accurate timing.

PHASE 3
THE IMMUNOASSAY
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

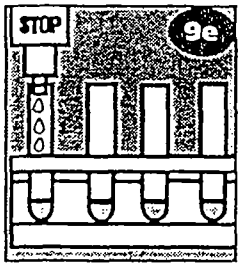
COLOR DEVELOPMENT

9a Add 5 drops of Substrate A (yellow cap) to each antibody coated tube.

9b Set timer for exactly 2 ½ minutes.

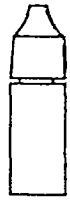
9c Start timer and immediately add 5 drops of Substrate B (green cap) to each antibody coated tube.

9d Shake all tubes for 5 seconds. Solution will turn blue in some or all antibody coated tubes.



9e Stop reaction at end of 2 ½ minutes by adding 5 drops of Stop Solution (red cap).

Note: Blue solution will turn yellow when Stop Solution is added.

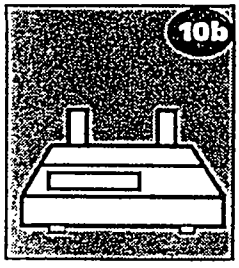


Substrate bottles (A, B, & Stop Solution)

PHASE 4
INTERPRETATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SELECT STANDARD



10a Wipe outside of all antibody coated tubes.

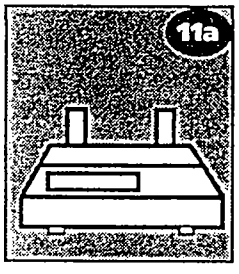
10b Place both Standard tubes in photometer.

10c Switch tubes until the photometer reading is negative or zero. Record reading.

If reading is greater than – 0.3 in magnitude, results are outside QC limits. Retest the sample(s).

10d Remove and discard tube in right well. The tube in the left well is the darker standard.

MEASURE SAMPLE



11a Place 1 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 1 ppm.

11b Place 10 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 10 ppm.

AROCLOR SENSITIVITY

Aroclor	Lowest Detection Level
1248	1.0 ppm
1254	0.4 ppm
1260	0.4 ppm
1242	2.0 ppm
1232	4.0 ppm
1016	4.0 ppm

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each PCB RISc Soil Test System contains enough material to perform four complete tests, each at two detection levels, if desired.

The PCB RISc Soil Test is divided into three phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-242-RISC (7472).

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PCB-free soil and soil containing 1 ppm or greater of PCBs were tested with the EnSys PCB RISc analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PCBs. A sample that has developed more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

The company does not guarantee that the results with the PCB RISc Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

EnSys, Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

EnSys, Inc. neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall EnSys, Inc. be liable for incidental or consequential damages resulting from the use or handling of this product.

How It Works

Standards, Samples, and color-change reagents are added to test tubes, coated with a chemical specific to PCBs. The concentration of PCBs in an unknown Sample is determined by comparing its color intensity with that of a Standard.

Note: PCB concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PCBs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after any portion has passed its expiration date.
- Do not attempt the test using more than 12 antibody coated tubes (two of which are **Standards**) at the same time.
- Do not exceed incubation periods prescribed by the specific steps.
- Always dispense correct number of drops and wash the number of times indicated in this guide.
- Use EPA Method 8080 or Code of Federal Regulations Title 40, Part 136, Appendix A, Method 680 to confirm results.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If Stop Solution or liquid from the extraction jar comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Standard Solution contains PCBs. Test samples may contain PCBs. Handle with care.
- Operating Temperatures – 40 - 90°F
  (4) - (32)°C

MECHANICAL PIPETTE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE MECHANICAL PIPETTE

To Set Or Adjust Volume

Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "030". Tighten volume lock screw and replace push-button cap.

To Assemble Pipette Tip

Slide larger mounting end of pipette tip onto end of pipette. Holding tip in place, press push-button until plunger rod enters pipette tip. Ensure no gap exists between piston and plunger rod (see illustration).

To Withdraw Sample

With tip mounted in position on pipette, press push-button to first stop and hold it.

Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.

To Dispense Sample

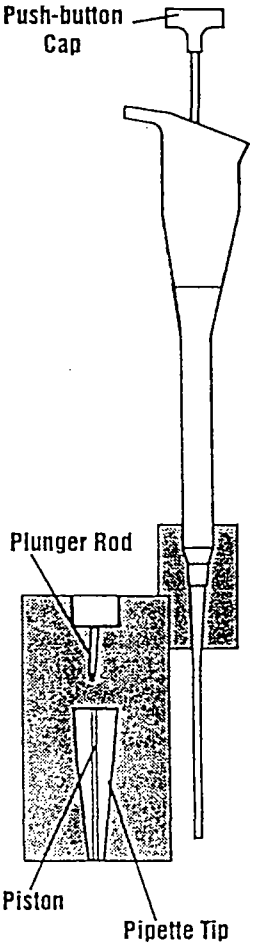
Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject).

Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipette, please refer to your pipette manual.



ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS
EnSys RISC® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. EnSys recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of EnSys RISC® immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)

D. **Method blank** - field analyze the contents of an unused extraction jar

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

EnSys technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives.

Data for PCB RISC® Soil Test

Operator: _____ Date: _____ Location: _____

Sample ID	ΔOD	OD sample	Interpretation	OD sample	Interpretation	Comments
	Standards	_____ ppm		_____ ppm		